Notebook, N-99-07-17

#1

Calculations

7-17-99. 7

Storage Battery

L. Blank – Electro Chem – 196

$PbO + 2H_2SO_4$ aq. $+ Pb = 2PbSO_4 + aq + 87000$.

[207+32] 239

239.
196.2
207.
327.0
969.2 gr = 87000 Cal

969.2 gr = 87000 × 1.8 = 156600 B.T.U.

969 / 1566 (1.62 B.T.U. per lb.

162 / 2595 (15.7 lb. per H.P. hr.

$\frac{15.7 \times 523}{969}$ =

1572 = 1959
7785
9144
9863
9281 = 8.5

7-17-99

Storage Battery —

M. Accumulator Co. Cat. / '98

Type F-

19 Plates 10½ × 10½

8 hour disc. at 90 Amp —

At 2 Volts = 8 × 2 × 90 = 1440 Watt hrs —

750 / 1440 (1.9 Watt hr

56

690

675

150

Weight of each element 1.84 lbs

Weight of all complete with acid in lead lined tank 4.15 lbs

Weight of acid in lead tank 1.24

Weight of acid in Pearl tank a year 50% lighter than glass jars —

1.9 / 1.84 / 17 (.97 lbs of element per Watt hr

130

1.9 / 4.15 / 38 (2.18 lbs of complete cell per Watt hr

55

19

160

1.9 / 1.24 / 17 (.65 lbs acid per Watt hr

100

Tank outside 2 1/4 × 15 × 17 1/4 high

7-17-99

Type E.

15

Plates 7 7/4 x 7 7/4

Discharge 8 hrs at 35 Amp.

8 x 2 x 3.5/12 = 5.60 Watt hrs. 1.747 Ft lbs

Weight of elements 7.1 lbs

Rubber jars 5/2 x 5/2 x 11

Weight of acid in cells 2.1 lbs

No. of cell comp. with acid in cells 9.1

.75 / 7.10 (94.7 lbs element Ft lbs

.75 / 2.1 (28 lbs acid Ft lbs

.75 / 9.1 (12.1 lbs comp. cell Ft lbs

5 hr disc. at 4.9 amp. 12.1 x 7/5 = 13.6 lbs comp. cell per Ft

5 hr disc. at 7.0

12.4 x = 16.1 lbs per Ft hrs

7-17-99.

Edwin Leland —

Thermal effects —

Formation of Zincate left out —

ZnO = 85400 . 0 Zn = 65.0 Ca = 63.4

CuO = 37100 / 48300 Cu O = 79.4

65 / 79.4 (1.22 — Heats. for 1 lb Zn —

650 / 1440 / 1300 / 140

2545 = 3.4056

453.6 / 6839 / 2553 / 49392 / 65 / 61129 / 3.1263

3.1263 = 1.9 lb of Zn per H.P. hr.

1.9 × 1.22 = 2.318 CuO per H.P. hr.

2.318 / 232 / 116 / 2.318

2.318 + 1.9 = 3.218 acid per H.P. hr.

---

1 lb = 453.6 gr.

Zn = 1.21 gr. Zn per hr —

1 lb Zn = 453.6 Amp. hr —

746 × 1.3 / 1.21 =

453.6 × 1.9 =

746 = .8727 / 121 / 9555 / 9359

1.9 = .2795 / 454 = .6571 / 9359

.0196 = 1.04 Volts for cell —

Thermal Relations 7-17-99

CuN_2O_6 mwt = 82.2 eq

63.4 / 82.2 = 4.9149 / 1.8 = 2553 / 187.4 / 5.1702

63.4 / 1.8021 / 5.3687 = 2330 - T_f

8-021 / 2718 / 5403 = 33.9% Cu

$Cu_1O_1SO_3$ aq = 55.960

63.4 / 54 = 4.7482 / 1.8 = 2553 / 159.5 / 5.0035

63.4 / 1.8021 / 3.2019 = 1590

8-021 / 2041 / 5980 = 39.6%

$Cu_1O_1N_2O_5$ aq = 524.10

187.4 / 524 = 4.7193 / 1.8 = 2553 / 63.4 = 8021 / 3.1725 = 1490

= 31.9% Cu

NiO_2 = 74.0 - 93.7

59 / 74 = .8692 / 18 = 2553 / 1278 / 5.1245 / 5.9 = 1.2709 / 3.3556 = 2260

5.1245 / .13 = .1139 / .01.06 = 1.030

45.4%

.9746 / 187 = 2715 / 7028 = 5041

.9746 / 63.4 = 8021

.9746 / 187 = 2715 / 2553 = 1134 / 2270 = 1570 / 7709 = 7709 / 45.61 = 28.60

2270 / 1139 / 1131 = 1.000

7.99
159.8

$Ni Ba_2$ 718 cu knt

59
159.8
218.8

718 = 8561
14 = 2553
59 = 6008
8299 = 6760

219 · 3404
2604 = 1820

7709
3404
4305 =
26.9% Ni

718 = 8561
14 = 2553
1114
7709
3405 = 2190

219 3404
7710 = 590

$Ni I_2$ - 414 cu knt

126.6
414 = 6170
18 = 2553 572
2539
59
3126

8723
5709
1014 = 1260

7709
1342
2767 = 189

N_2O, H_2O - 608.00

59
549
93

608 = 17839
18 = 2553
0392
7709
1207 = 1850

.039 = 7709
9685
80.24 = 63

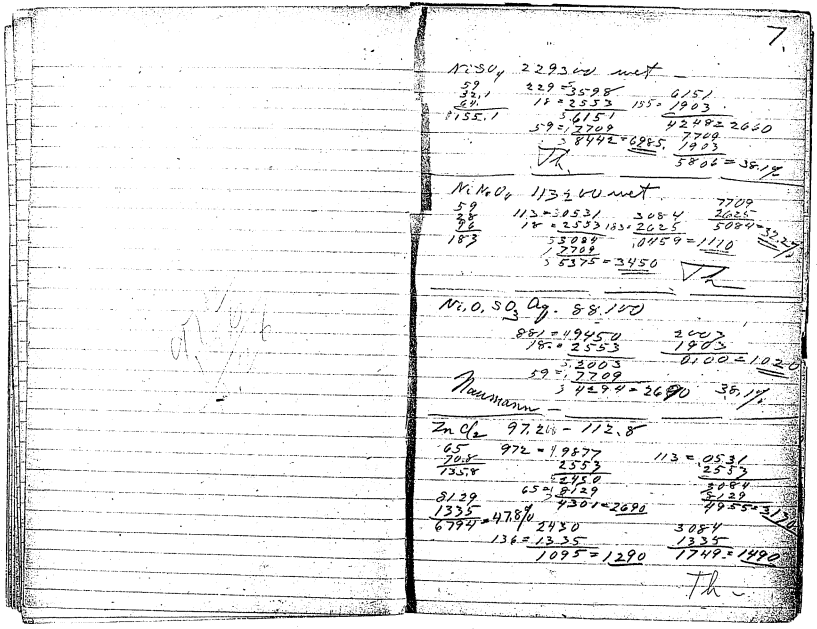
$Ni_2 S_3 m H_2O$ - 2936.0 Dm

59
36.1
91.1

193 = 2856
18 = 2553
5409
7709
54 = 7700 = 589

5-409
9595
5814 = 811½

7709
6395
64



7.

$Ni SO_4$ 229 gm met

59 — 229 = 3598 — 6151
32.1 — 18 = 2553 — 155 = 1903
64 — 5 6151 — 4248 = 2660
155.1 — 59 = 2709 — 7709
3 8442 = 6885 — 1903
5806 = 38.1%

$Ni N_2 O_6$ 113.66 met

59 — 112 = 30531 — 3084 — 7709
28 — 18 = 2553 183 = 2025 — 5084 = 33.2%
92 — 53088 — 10459 = 1110
183 — 2709
3 5378 = 3450

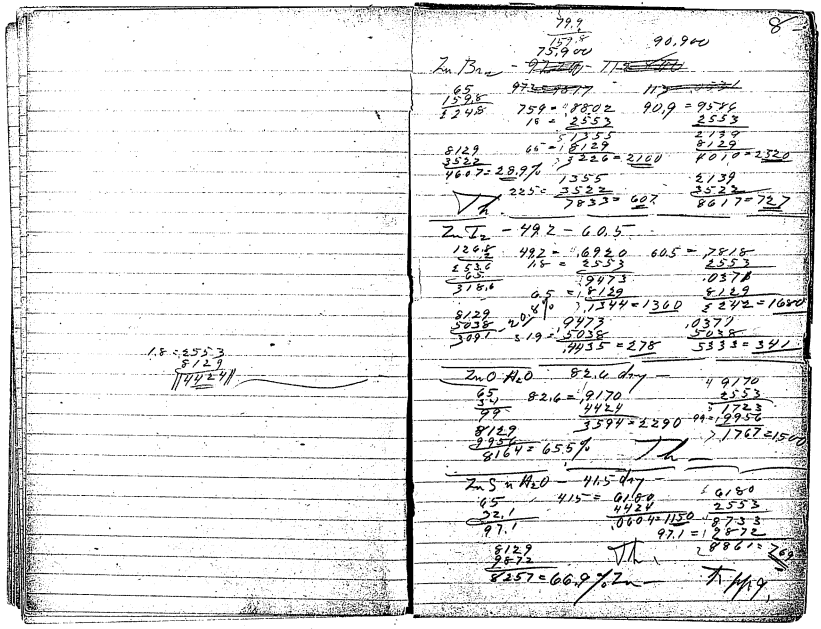
$Ni, O, SO_3 Aq.$ 88.15%

881 = 19450 — 3003
18 = 2553 — 1903
59 = 2709 — 0100 = 102.0
3 4294 = 26.90 — 36.1%

Naumann

$Zn Cl_2$ 97.2% = 112.8

65 — 972 = 19877 — 113 = 05331
70.8 — 2553 — 2553
135.8 — 2450 — 3084
65 = 8129 — 5429
81.29 — 9301 = 2690 — 7655 = 3170
1335
67.94 = 47.8%
2450 — 3084
136 = 1335 — 1335
1095 = 1290 — 1749 = 1490



7-18-99

To decompose ZnO, H_2O

$ZnO, H_2O = 82.616$

1 Amp hr = 1.121 gr Zn

1.121) 65.00 (58 Amp hr = 65 gr Zn

896
168
930

82.16
3.971
57822
74334
24778
327.79 = B.T.U.

2.51559
9.4669
1.98222
1.7308
.12514 = 1.78 Volt

B.T.U. / 1 watt hr = 3.413 watt hr

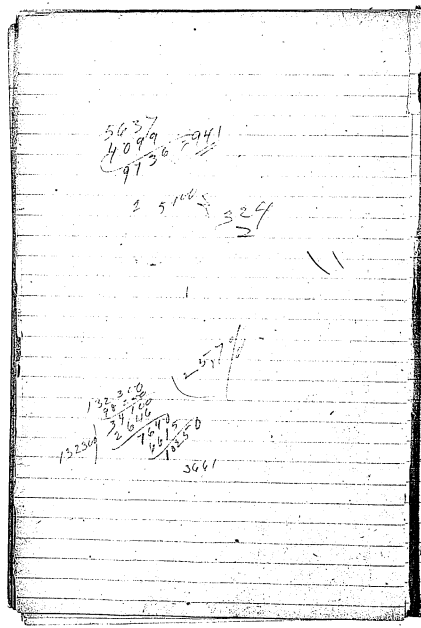
328 X 1.297 = 425.4

425.4 / 82.16 = 5.18

23.14
9315
1829
9170
2659 =

$ZnO = 85.14$

$\frac{1.78 \times 85.14}{82.16} = 1.84$ Volts



$ZnSO_4 \cdot 230 - 248.4$

65 / 32.1 / 64 / 161.1 | 65660 / 6447 / 5600 / 4833 / 7670 | 100.3 | 6047.

230 = 3617 − 53617
4424 — 15 = 2553
6330 — 561 70
161 = 2064
9702 = 2570

248.4 = 3945
4424
8827 − 8900

3995
2553
6498
2068
4430 = 2770

65 = 8129
2068
6061 = 40.4%

Zn_2O_4 - wet 132.3

65 / 28 / 90 / 189 | 8129 / 27665 | 5364 = 34.4%

132 = 1213
4424
5637 = 3660

1213
2553
3766
189 = 2765
1001 = 1260

Zn O Conc — 85.4

65 / 16 / 81 | 8129 / 9085 | 9044 = 80.2%

85.4 = 9315
4424
3739 = 2370

9315
2553
1868
81 = 9085
2783 = 1900

$Zn_2O_2SO_4$ aq 100.1

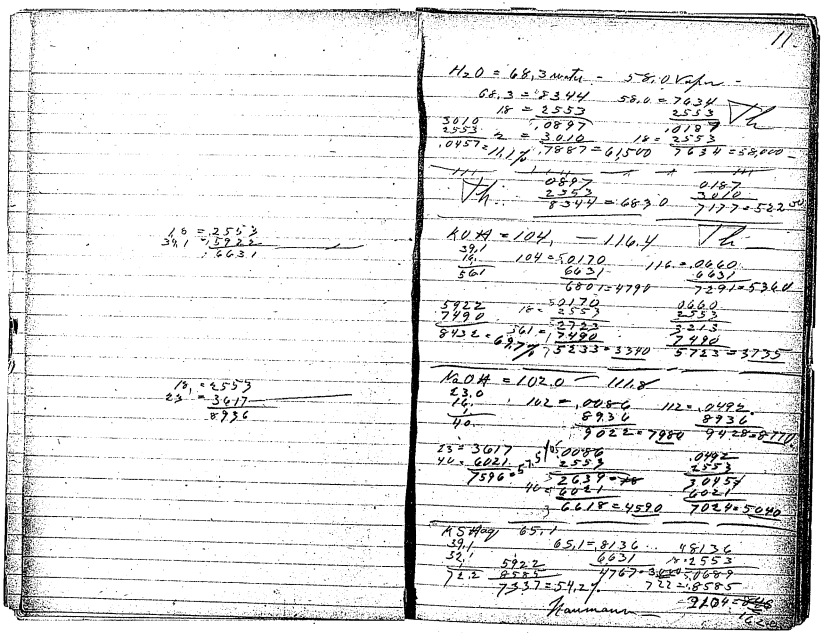
100.1 146 = 0257
4424
14681 = 2944

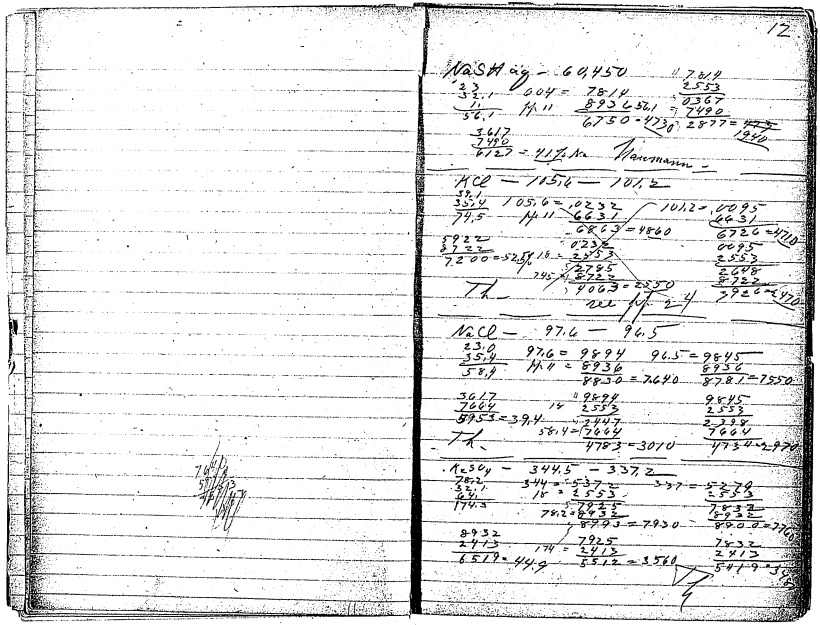
5,0257
16 = 2553
5 12810
161 = 2068
0774 = 1180

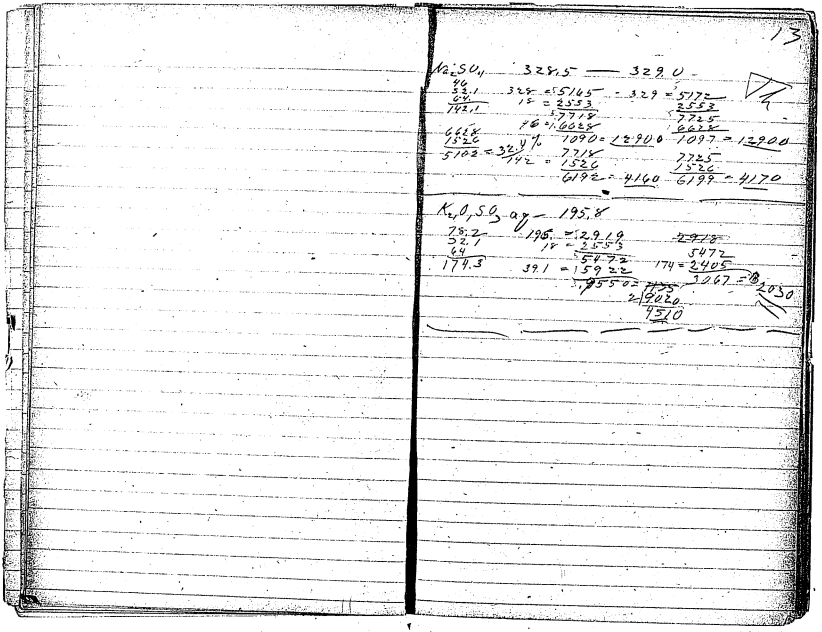
5637
4089
9736 = 941

2 5166 = 324
3

1323.9
28.7766
26.106
1323.0 | 1647.5 | 1325.0
3641






13
Na_2SO_4 328.5 — 329.0
142.1 328 = 5165 - 329 = 5172
32.1 15 = 2553 2553
64 7718 7725
176.1 #6 = 1.0025 6025
6618 1090 = 12900 1097 = 12900
1526 7714 7725
5102 = 32 142 = 1526 1526
6192 = 4160 6197 = 41170
K_2O,SO_3 aq — 195.8
78.2 195 = 2919 2918
32.1 15 = 2355 5472
64 5472
174.3 391 = 15922 174 = 2405 = 3067 = B 2030
19550 2 9020
9510

7-19-99 -

Electrolysis -

Pt

20% KOH. Sol. continuously
Zn + amalgamated - graduall
increase voltage - Obtain electr
small amount of gas from - elec
at 1.2 Volt - About the same
up to 1.5 Volt - A slight Cu
deposit possible after several hrs
The sol. was pink small Edison
Cell partially discharged
at about 1.0 Volt Zn is
gas at + elec -

Get Zn at about 1.9 Volt -
Slight deposit, apparently
Cu at 1.6 Volt -

7-19-99 15

Electrolysis

25% KOH sol. Zn C_2H_2 added and Cu dissolved from sheet Cu anode —

Cu begins to deposit at 1.2 Volts voltage gradually raised to 1.6 Volts deposit bright at first then black & fine grain at 1.6 Volts —

Cu all comes out in time, not in visible at 2 Volts — but may have come on black deposit —

7-22-99

Theoretical Battery —

20 plates for Zn 10½ × 42"

Total area 21 × 42 × 20 = 17,640

Weight of Zn per .001" deposit

17.64 ÷ 4 = 4.41 lb

1.9 lb Zn per Ft. hr (14.4)

.001" deposit = 4.41 / 1.9 = 2.32 Ft. hr.

1.9 | 4.41 (2.32
38
61
57
40
38
2

1 Ft. hr = .001 / 2.32 = .00043 1" deposit

1 Amp. hr. per sq in = .0012 × 2.2 = .00266 lb

1 Amp hr per sq in for cell = .00266 × 17644 = 46.9 lb

17644
2.64
10584
10584
3528
46922.4

1 Amp hr per 3 sq in = 46.9 / 3 = 15.6 lb

15.6 × 28 = 436.8 lb

436.8 / 53.4 = 8.2 Ft. hr

1.9 | 15.6 | 8.21
152
40
38
2

1 Amp hr per 3 sq in = 8.21 / 2.32 = .00354

2.32 | 8.21 (3.54
696
1250
1160
900

Ni grid .003" thick

Weight 8820 x .003 x .317 = 8.35 lbs Ni

.886 = 3.9955

.517 = 2.4771

.317 = 1.9011

.9237 = 8.35

Ni Fe plated with min .001" all over

Weight of Fe 8820 x .002 x .26 = 4.59 lbs Fe

3.9955

.562 = .7600

.6615 = 4.56

Assume temp - 1hr on 3" thk sheet -

15.6 lbs Fe / sq. ft.

(pp. 14)

(pp. 4) 15.6 x 1.22 = 19.0 lbs O2 required

312

156

19.032

Stoic. O2 = 6.3

19.0

6.3 x .936 = 83.8 cu. in. O2 / sq. ft. Cu

63 = .7993 19 = 1.2788

36 = .5563 9.3556

9.3556 1.9237 = 83.8

41.9

125.7

With 33⅓% voids 125.7 cu. in. / sq. ft.

2 1/2

~~19~~ grade = 125.7 / 19 x 10.5 x 10.5 = 1 1/12 / 5.4

19 = 1.2788 126 = 1.1004

110 = 2.0414 3.3202

2.3372 .055 = thick

8.7802 = ~~.060~~ thick

Allowing for ▭▭▭ make space
in height .07 "

No. grad. for CuO
8.35 / 20 × 40 / 2 = 3.97 gms in gm. 397

20 plates m=1/16" thick = 5 "
20 " ▭ .08 " 1.58 "
19 spaces 3/8 " 7.12 5.8
22.5
1/4 inch on end 2.5 "
11 × 11 × 23 — 7 cc

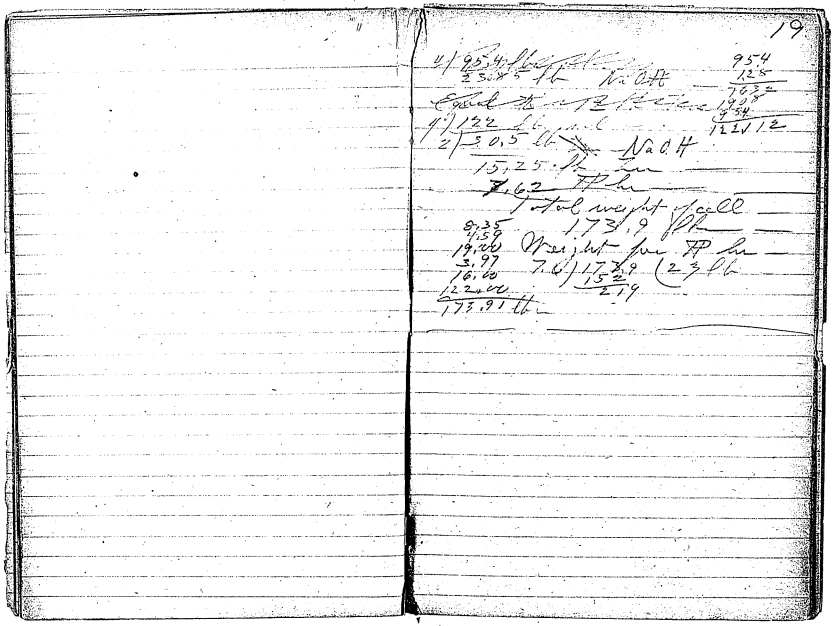
Vol of cell 11 × 11 × 23 = 2783 cu mm
2783 − 141 = 2642

Wt Ni = 3.9748.35 = 39 cu mm
.217 / 1.232 (39
957
2570

Vol iron = 18 cu mm
" CuO = 84 " "
141 " "

" Al 2783 − 141 = 2642 Cu mm

Sp. gr. Al = 25% = 1.28
Weight .0361 × 2642 = 95.4 mg
2642
.0361
15852
79260
95.3762



7-25-99 20

Iron Deposits

see pp 34 -

Iron sulphate, $FeSO_4$ with about ½ the amount NH_4Cl does well, iron sat - Addition of a little HCl and iron anode seems to emphasize it -

NH_4Cl with iron anode gives best deposit but soln oxidizes rapidly -

$FeSO_4$ & NH_4SO_4 fair -

NH_4Cl → N. G -

$FeSO_4$ precip by NH_4Cl, and redissolves in HCl fair -

$FeSO_4$ & Ammo. Oxalate fair -

7-26-99 21

Na_2O, SO_3 - 9% - 186.640

142.1 187 = 5.27749 / 1.2553 = 142 — 5262 / 1526 = 3736 = 2360

5,526 = 4.6 / 1.6628

5,863 = 7300

Naumann —

K_2O, aq 164560 — 94.3 / 78.3 / 18 — 9% — 5.4713 / 1.9745 = 3.4968 = 3140

10% = 5.2160 / 18 = 1.2553 = 5.4713

78.3 / 1.8938 / 1.9745 = 83% — 1.8938 = 3.55775 = 3780

Naumann —

Na_2O aq - 155260 — 62 / 155 = 5.1911 / 18 = 1.2553 = 5.4464 = 4.6 / 1.6025 = 5.7052 = 6080

9220 / 9220 / 8708 = 74.2% — 4460 / 7924 / 6340 = 75% = 4760

Naumann —

HCl = 22000 - 392.00

36.4 / 22000 = 4.3424 / 10 = 1.2553 — 392 = 4.5944 = 4.5977 = 39600 / 36.4 / 1.5611 = 4.0366 = 1940 — 4.8497 = 70700 — 3.2846 = 1940

Ostwald

H_2SO_4 = 19300 - 21090

32.1 | 64 | 98.1 — 193 = 26.58 — 18 = .2557 — ? = 5.5411 — 5.2401 = 174700 — 5.5411 — 1.9917 = 3540 — 5.5411 — 1.3065 = 7.0346 = 10800

211 = 5.3241 — 2353 — 5.3794 — 3010 — 5.2784 = 180000 — 5.5794 — 2.9917 — 3.5877 = 38700 — 5.5794 — 1.3065 — 4.0729 = 11500

3065 | 9917 | 5778 = 32.1

SO_3 = 10330 - 14250

32.1 | 16 | 80.1 — 103 = 5.0140 — 18 = .9553 — 5.9693 — 1.9936 — 3.3657 = 2320

142 = 1.1538 — 2353 — 1.9191 — 1.9936 — 1.3585 = 3800

Just H, SO, and SO_3 = 5.2693 — 1.9917 — 3.2776 = 1890

4991 | 9917 | 4178 = 2610

HNO_3 = 4190 - 4910

14 | 48 | 63 — 419 = 4.6222 — 18 = .2553 — 4.8775 = 75400 — 47 = 1.7997 — 3.0778 = 47990

491 = 6911 — 2553 — 9464 = 38400 — 7993 — 1471 = 1440

2007 = 1.597 H — 14 = 1461 — 7993 — 3768 = 22.2 % N

N_2O_5 = 13100 − 29800

131 = 4.1173 . 29 = 4702
18 = 2553
4.3726
μ lb N_2O_5 108 = 2.0334
2.3392 = 218
7295
0334
6961 = 897

μ lb HNO_3 = 4.3726
2.1004
2.2722 = 187
7295
10004
5291 = 426

NH_3 = 12000 20400

124 = 4.0792
18 = 2553
4.3345
μ lb N = 4.2.1341
3.1884 − 1540
μ lb NH_4OH = 4.3345
3064
2553
15449
11341
4108 = 2220
4.3449
1.5441
3.10208 = 1050

H_3PO_4 = 302900 − 305600

3 503 = 5.4813 306 = 48.51
64 18 = 2553
28 5.7366
3 = 4771
5.2595 = 182000
7404
4771
2633 = 183000

98 = 5.7366
1.9772
4771
9912
4859 = 3.06
3.7454 = 55644
7404
9912
7492 = 5610

51 = 4914
9912
5002 = 31.6

$K_2O_{5.97} \cdot 2X_2O_3 \cdot 6W$

$406.00 / 18 = 5.6055 / 2.2553$

5.8608

per lb H_3PO_4 1.98 $= 2.2923 / 5.5715 = 3730$

$KClO_3 = 959.00$ (39.1 / 35.4 / 48. / 122.5)

per lb $K = 959.00 \times 1.8 / 39.1 = 4410$

per lb $KClO_3 = 959.00 \times 1.8 / 122.5 = 1410$

$39.1 / 122.5 = 31.8\% K$ $35.4 / 122.5 = 28.9\% Cl$

KCl $1043.00 - 999.00$

per lb K - $1043.00 \times 1.8 / 39.1 = 4800$ 4800

$39.1 / 74.5$ $999.00 \times 1.8 / 39.1 = 4620$

per lb $KCl = 1043.00 \times 1.8 / 74.5 = 2530$

$999.00 \times 1.8 / 74.5 = 2420$

$39.1 / 74.5 = 52.5\% K$

$Na_2O = 804.00 - 1354.00$

per lb Na $804.00 \times 1.8 / 46 = 3150$

$1354.00 \times 1.8 / 46 = 5300$

per lb $NaOH = 804.00 \times 1.8 / 80 = 1800$

$1354.00 \times 1.8 / 80 = 3050$

46 / 35.5 / 80

NH_4Cl 75600 — 71800

per lb NH_3 = $\frac{75600 \times 1.8}{18} = 7560$

$\frac{71800 \times 1.8}{18} = 7180$

per lb NH_4Cl = $\frac{75600 \times 1.8}{53.4} = 3850$

$\frac{71800 \times 1.8}{53.4} = 3650$

$\frac{18}{53.4} = 51\%\ NH_3$

$(NH_4)_2SO_4$ = 28220 — 27900

per lb NH_3 = $\frac{28220 \times 1.8}{36} = 1411.0$

$\frac{27960 \times 1.8}{36} = 1398.0$

per lb $(NH_4)_2SO_4$ = $\frac{28220 \times 1.8}{132} = 3860$

$\frac{27960 \times 1.8}{132} = 3840$

$\frac{36}{132} = 27.4\%\ NH_3$

NH_4NO_3 = 8800 — 8180

per lb NH_3 = $\frac{8800 \times 1.8}{18} = 880$

$\frac{8180}{18}$

per lb NH_4NO_3 = $\frac{8800 \times 1.8}{80} = 1980$

$\frac{8180 \times 1.8}{80} = 1840$

$\frac{53.4}{36.1}$

$\frac{-36}{17.4}$

$Ca(OH)_2$ = 214900 – 217900

per lb Ca = $\frac{214900 \times 1.8}{40}$ = 96800

$\frac{217900 \times 1.8}{40}$ = 98500

per lb $Ca(OH)_2$ = $\frac{214900 \times 1.8}{74}$ = 52200

$\frac{40}{74}$ = 54.1% Ca $\frac{217900 \times 1.8}{74}$ = 53000

CaO = 121000 hydrated ~~146~~ 146500

per lb Ca $\frac{131000 \times 1.8}{40}$ = 59000

$\frac{146500 \times 1.8}{40}$ = 66100

per lb $Ca(OH)_2$ $\frac{131000 \times 1.8}{74}$ = 31900

$\frac{146500 \times 18}{74}$ = 35700

$CaCl_2$ = 169800 – 187200

per lb Ca = $\frac{169800 \times 1.8}{40}$ = 76600

$\frac{72.8}{110.8}$ $\frac{187200 \times 1.8}{40}$ = ~~87~~ 84200

$CaCl_2$ $\frac{169800 \times 1.8}{110.8}$ = 27800

$\frac{187200 \times 1.8}{110.8}$ = 30500

$\frac{40}{110.8}$ = 36.2% Ca

$CaSO_4$ = 318400 — 323100

In lb Ca = $\frac{318400 \times 1.8}{40}$ = 14360

$\frac{32.1}{40.}$ $\frac{64}{136.1}$ $\frac{323100 \times 1.8}{40}$ = 14500

$\frac{318400 \times 1.8}{136.1}$ = 41400

$\frac{40}{136}$ = 29.4% Ca — $\frac{323100 \times 1.8}{136.1}$ = ~~41500~~ 42600

$Ca(NO_3)_2$ = 202600 - 206600

In lb Ca = $\frac{202600 \times 1.8}{40}$ = 9110

$\frac{164}{40}$ $\frac{206600 \times 1.8}{40}$ = 9310

$Ca(NO_3)_2$ $\frac{202600 \times 1.8}{164}$ = 2220

$\frac{40}{164}$ = 24.4% Ca $\frac{206600 \times 1.8}{164}$ = 2270

$CaCl_2$ = 2704000

$\frac{12}{40}$ $\frac{2704000 \times 1.8}{40}$ = 12180

$\frac{48}{100}$ $\frac{2704000 \times 1.8}{100}$ = 4867

40% Ca

$Fe(OH)_2$ = 136700

34 / 237 / 271

$\frac{136700 \times 1.8}{237} = 1060$

$\frac{136700 \times 1.8}{271} = 910$

$\frac{237}{271} = \frac{87.5}{271}$ % Fe —

$Fe(OH)_3$ = $\frac{198200 \times 1.8}{237}$ = ~~1504~~ 1504

51 / 237 / 288

$\frac{198200 \times 1.8}{288} = 1238$

$\frac{237}{288} = 82.6\%$

Fe_3O_4 $\frac{269700 \times 1.8}{711} = 670$

237 / 711 / 775

$\frac{269700 \times 1.8}{775} = 614$

$\frac{711}{775} = 92\%$

$FeCl_2$ — 82100 — 100000

237 / 76.8 / 307.8

$\frac{82100 \times 1.8}{237} = 624$

$\frac{100000 \times 1.8}{237} = 759$

$\frac{82100 \times 1.8}{307.8} = 482$

$\frac{100000 \times 1.8}{307.8} = 585$

$\frac{237}{307.8} = 77.2\%$ —

$FeCl_3$ = 961.00 — 1594.00

$\frac{162.2}{237} = \frac{96100 \times 1.8}{237} = 730$

$\frac{96100 \times 1.8}{341.2} = 509$

$\frac{237}{341} = 69.3\%$ $\frac{159400 \times 1.8}{237} = 1210$

$\frac{159400 \times 1.8}{341.2} = 840$

$FeSO_4 \cdot 7H_2O$ = $\frac{235600 \times 1.8}{237} = 1780$

$\frac{32}{64}$ $\frac{235600 \times 1.8}{333} = 1270$

$\frac{237}{333} = 72.6\%$

$Fe_2(SO_4)_3 \cdot 9H_2O$ $\frac{618400 \times 1.8}{237 \times 2} = 2350$

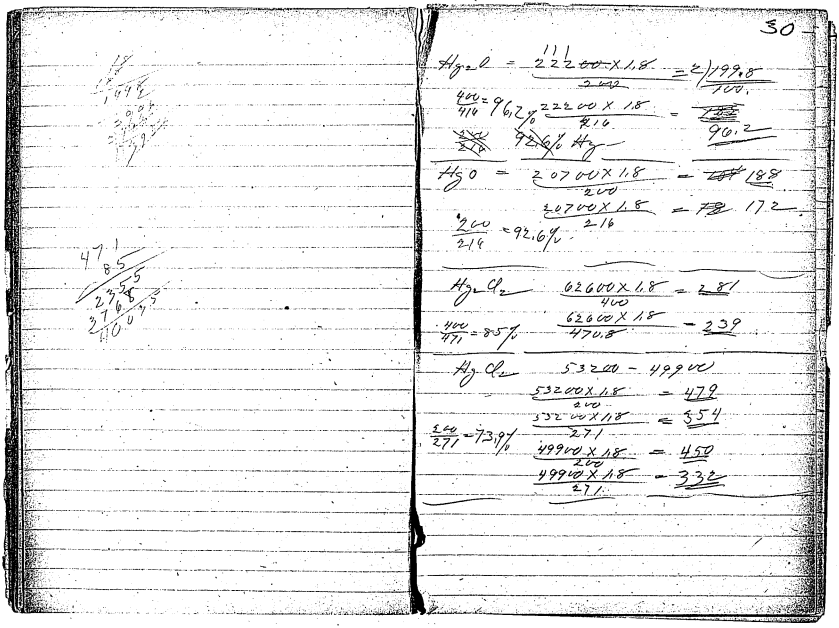
$\frac{237}{474}$ $\frac{3}{288}$ $\frac{618400 \times 1.8}{762} = 1460$

$\frac{474}{762} = 62.1\%$

$Zn(OH)_2$ = $\frac{15110.00 \times 1.8}{65} = 4190$

$\frac{34}{99}$ $\frac{15110.00 \times 1.8}{99} = 2750$

$\frac{34}{99} = 34.4\%$



30

$HgO = \frac{222\,00 \times 1.8}{200} = 199.8$

$\frac{400}{414} = 96.2\% \quad \frac{222\,00 \times 1.8}{216} = 96.2$

$96.2\% \; Hg$

$HgO = \frac{207\,00 \times 1.8}{200} = 188$

$\frac{200}{216} = 92.6\% \quad \frac{207\,00 \times 1.8}{216} = 172$

$HgCl_2 \quad \frac{626\,00 \times 1.8}{400} = 281$

$\frac{400}{471} = 85\% \quad \frac{626\,00 \times 1.8}{470.8} = 239$

$HgCl_2 \quad 532\,00 - 499\,00$

$\frac{532\,00 \times 1.8}{200} = 479$

$\frac{532\,00 \times 1.8}{271} = 354$

$\frac{200}{271} = 73.8\% \quad \frac{499\,00 \times 1.8}{200} = 450$

$\frac{499\,00 \times 1.8}{271} = 332$

Ag_2O $\frac{5900 \times 1.8}{216} = 49$

$\frac{216}{232} = 91.5\%$ $\frac{5900 \times 1.8}{236} = 45$

$AgCl$ $\frac{2940 \times 1.8}{108} = 486$

$\frac{108}{143} = 75.6\%$ $\frac{2940 \times 1.8}{143} = 370$

Ag_2SO_4 $\frac{1673.00 - 1628.00}{216}$

$\frac{1673 \times 1.8}{216} = 1395$

$\frac{1673 \times 1.8}{312} = 962$

$\frac{216}{312} = 69\%$ $\frac{1628 \times 1.8}{216} = 1358$

$\frac{1628 \times 1.8}{312} = 940$

Ag_2CO_3 $\frac{1229^{00} \times 1.8}{216} = 1020$

$\frac{216}{276} = 78.2\%$ $\frac{1229 \times 1.8}{276} = 800$

$AgNO_3$ $= 2570.00 - 2330.00$

$\frac{257 \times 18}{108} = 478$

$\frac{257 \times 18}{170} = 304$

$\frac{108}{170} = 63.7\%$ $\frac{233 \times 18}{108} = 389$

$\frac{235 \times 18}{170} = 247$

$Ag_2O, N_2O_5 aq$ — $\frac{16800 \times 1.8}{216} = 140$

$Ag_2O, SO_3 aq$ — $\frac{20400 \times 1.8}{216} = 169$

PbO — $\frac{503.00 \times 1.8}{207} = 437$

$\frac{207}{223} = 93\%$ — $\frac{503.00 \times 1.8}{223} = 406$

$PbCl_2$ — $828.00 - 76.000$

$\frac{828.00 \times 1.8}{207} = 719$

$\frac{828.00 \times 1.8}{278} = 536$

$\frac{207}{278} = 74.5\%$ — $\frac{76.000 \times 1.8}{207} = 660$

$\frac{76.000 \times 1.8}{278} = 490$

$PbSO_4$ — $\frac{2162.00 \times 1.8}{207} = 1880$

$\frac{207}{303} = 68.2\%$ — $\frac{2162 \times 1.8}{303} = 1250$

$PbMoO_4$ — $1055.00 - 979.00$

$\frac{1055.00 \times 1.8}{207} = 917$

$\frac{1055.00 \times 1.8}{351} = 572$

$\frac{207}{351} = 62.6\%$ — $\frac{979.00 \times 1.8}{207} = 852$

$\frac{979.00 \times 1.8}{351} = 532$

$PbCO_3$ = $\frac{72 \text{ mgx } 1.8}{267} = 632$ $\frac{207}{267}$

$\frac{207}{267} = 77.5\%$ $\frac{729 \times 1.8}{267} = 490$ $\frac{1.8}{267}$

$Pb_2O_3SO_4$ $\frac{738 \text{ cc} \times 1.8}{207} = 640$

$\frac{738 \text{ cc} \times 1.8}{303} = 435$

$Pb_2O_3N_2O_5$ $\frac{685 \text{ cc} \times 1.8}{267} = 591$

$\frac{685 \text{ cc} \times 1.8}{331} = 370$

$Sn(OH)_2$ $\frac{1365 \text{ cc} \times 1.8}{118} = 2080$ $\frac{118}{152}$

$\frac{118}{152} = 77.7\%$ $\frac{1365 \times 1.8}{152} = 1620$

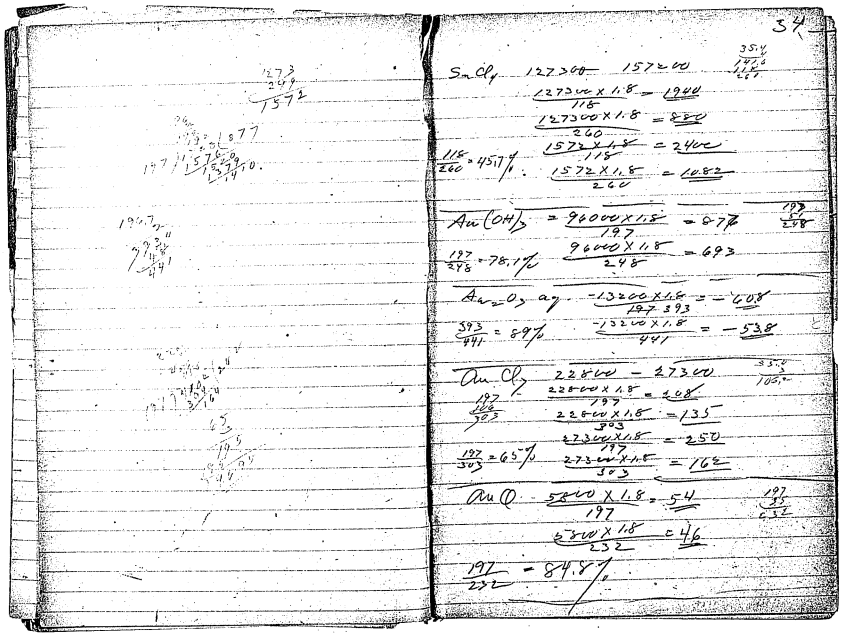
SnO_2 $80600 - 81100$ $\frac{118}{150}$

$\frac{80600 \times 1.8}{118} = 1230$

$\frac{80600 \times 1.8}{159} = 769$

$\frac{118}{159} =$ $\frac{811 \text{ cc} \times 1.8}{118} = 1240$

$\frac{814 \text{ cc} \times 1.8}{159} = 772$



7-28-99

To heat $Cu(NO_3)_2$

$Cu(NO_3)_2 + (H_2S) + H_2O = 2HNO_3 + Cu + O$

$+ 68300 = 49100$ $\quad 140600$

$\quad 98300 \quad 42200$

$\quad 140600 \quad 91300$

$\quad 42300 \quad 49300$

$2NaNO_3 + Cu$

$Cu, O, N_2O_5aq = 52410$

$\frac{52300}{46400} = 1.13$ Volt

$CuSO_4 + H_2O = H_2SO_4 + Cu + O$

$17800 + 68300 = 210900 \quad +55800$

$\quad 198400$

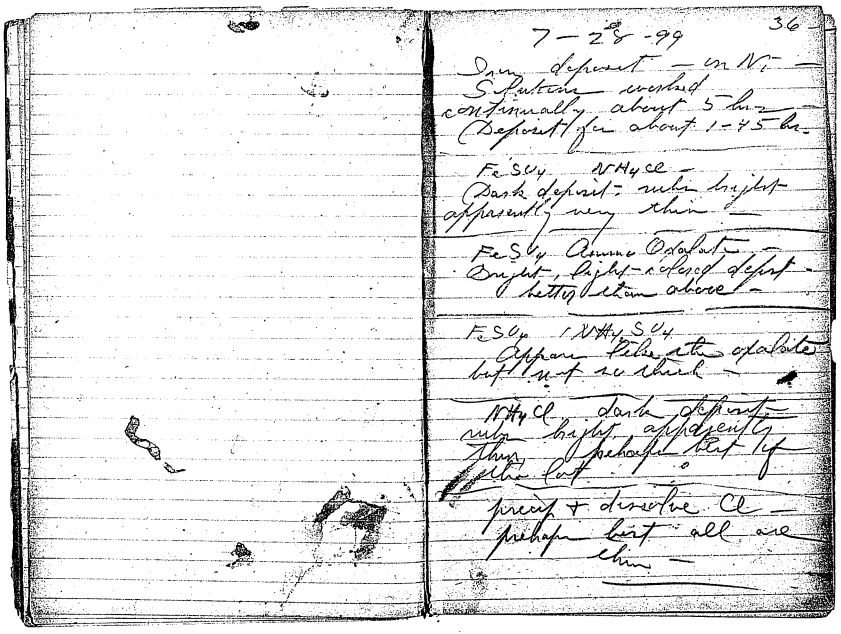
$\quad 266700$

$\quad 210900$

$\quad 55800$ $\quad \frac{558}{464} = 1.22$ Volt

$CuCl_2 = Cu + 2Cl$

62200



7-28-99 36

Iron deposit — on N. —
Solution worked
continually about 5 hrs —
Deposit for about 1-45 hr.

$FeSO_4$ NH_4Cl —
Dark deposit = rubs bright
apparently very thin —

$FeSO_4$ Ammon Oxalate —
Bright, light-colored deposit —
better than above —

$FeSO_4$ $(NH_4)_2SO_4$
Appears like the oxalate
but not so thick —

NH_4Cl dark deposit
rubs bright apparently
thin, perhaps best of
the lot.

$FeCl_3$ + dissolve Cl —
perhaps best all are
thin —

To reduce 25% NaOH Sol to 20% Sol

Sp gr of 25% with Sp gr 1.40

Wt of 100 cc 25% = 124 gr.

" " NaOH in 100 cc = 32 gr.

" " H_2O in 25% = 96 gr.

" " H_2O in 20% = 128 gr.

Add 32 cc of 32 cc H_2O

100 cc Sol — 20%

132 | 240 | 24.2 | 48.4

2376

5640

528

5120 48.4 | 151.6

Sp gr sol with Zn 1.32

To make 175 C.C.

242

175

1210

1694

242

42350

42.3 H_2O

132.7 Sol

Determination of Ni in reg. sol.

20 c.c. stock sol.
15-5 c.c. H_2O
Slight ppt. not enough
to decant - Thrown out 1.2693 5
Weight of Ni, elect. 10.8425
2.1093
Current .19 Amp 12 V.
Add 7gr NaOH at 1-45
Separation not complete
20 c.c. of 25% sol = $\frac{1.2 \times 25}{4}$ = 6.7 gr NaOH

5 c.c. stock sol
add H_2SO_4 to reduction
Weight elect 14.9922
Iron Found 10.8841

8-3-99

KOH sol'n in R cell — 70 gr.
20% by weight — Sp. gr. 1140 = 16%

2:30 P.M.	3.8 amp
3:40	4.4
3-20	5.4
5-0	5.7
9	5.7
8 A.M. 8-4-99	4.5
10	3.0
11-30	

8-5-99

Motor: Local action, make connection 2 P.M. - 6.5 Amp
died in a few minutes

Transfer to new cell - 70 gr.
current start at 1 amp. 2:10 P.M.
evidently coating it in C.O.
2:15 - 2.7 Amp
3:15 - 5. Amp
9:30 AM 8-6-99 4.3 "
4-0 P.M. 3.8
5-0 5.8

8-2-99 40

Nickel in oxide contains a large amount of iron —

Oxide stuffed with Cu — reduced in 20% NaOH, and on oxidizing gave off large amount of Th. Apparently from the scale. Same Fe & Th — Kept washing them to get all out, or dissolved out but not get on much on front.

Nickel oxide in 20% NaOH gave off Fe when oxidized & evaporated with funic —

8-4-09

Weight of Standard grid 4.57
" " Scale 5.975 gr
8.2 gr

Size of grid, 2½ x ¾ x ⅛

Second 25% NaOH Sol
with Sp. gr. approx 1.44 & gr —
much heavier than 1.32 Sol —

To reduce to Sp. gr. 1.32 —

100 cc sol
145 / 45 cc (3/4)
125
500

45 cc H_2O
175 175
31 54 cc H_2O
175
515
54.25 120 cc H_2O

Cement

Oxychloride Magnesia

Chloride sol — 1.26 sp gr — 28%

1st part — Thick paste
2nd " — Thin " 5 gr. 23 cc
3 " — Fluid

4
5 } Dilute sol with 25% sol of water
6

7
8 } Dilute original sol with 50% sol water if first addition is OK

8-29-99 11-75

#1 A

5 gr. MgO 11 cc $MgCl_2$ sol — 1.265 sp gr — = 28% $MgCl_2$

67 Hrs set

Mottled appearance quite hard to touch very smooth even under microscope part translucent milk white & part translucent

#1 D — Same 16 cc Sol — Uniform in appearance. Blue pasteform, about same hardness as #1. fracture like china — 67 hrs —

23 cc sol — Above free water on surface many bubbles after stirring #1 but equally good appearance — Softer to touch — 68 hrs —

#3 30 cc sol — Here #3.0, good appearance a little soft — 68 hrs —

#4 15 cc [illegible] sol diluted with [illegible] #0 — Soft — good appearance 68 hrs —

#4a 15 cc or above 42 hrs off ground in metal basket clear #4 nearly as hard as #1 — Mottled appearance and one or two bubbles —

#5 — Mottled, quite hard but not like 4L — 42 hrs —

#6 rather soft — not so smooth as above — Much very light & saucer — 42 hrs —

#7 cracked on drying rather soft — 1 bubble — 42 hrs —

#8 cracked drying, about very soft, fiber surface —

#9 soft, on surface not bright & glaze — left good

#2 & 3 thrown out finished #1-4a-6-+9 sum test 2-3 very dry except for [illegible]

Sp. Gr. of 20% with Sodium
1,200 = 18.58% KOH

Sp. Gr. = 30% Potash
1,212 = 23% KOH

Attach cell 645 gr Zn
Cell exhausted 388 " "
~~5 bbl~~ weight KOH.
1030 1214 + gr = 23%
2400 - H2O
645 Sp gr with Zn 1,310
~~388~~
257 gr of Zn ins

All these cells
in water, the
hardest can be moved
with finger nail

Water in KOH sticks —

29.0 gr water
10.30 " sticks
39.30

34.30
2.5
1029
636
1588.9 gr KOH

103 / 78.9 (76.6 % KOH —
25
650
618
620

To make 150 cc 35 % sol —
sp gr = 1.349

2430
2.5
1215
729
850.5 gr KOH —

1.35
150
1050
135
2430 gr.

76 / 85.05 (112 gr sticks —
760
905
760
1390

85
27

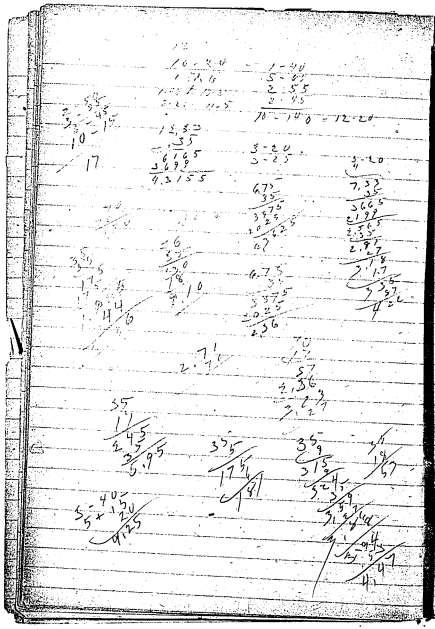
2.43
35 —
1.58 gr water
27
131 cc H_2O

Sp gr not with Zn 1.490

Mol Zn 56 gr
24.6
31.2

59
55.9
3.1 distributed thru mass

31 gr Zn & 112 gr sticks drop off
same relative amount as in 35 % sol



Life of Snad

commercial scale washed - 3.5 Ang.

Bubbler on first situation 4.32 Ang. hr

#1 oxidized 2.36 Ang. hr

#2 " 3.18 " "

3 " 3.35 " "

3 " 2.36 2.369 1.81

1 2.36

2 " 2.71 2.774 1.81

Solid Snad

Weight 12.55

Index of grade 7.7 Ang hr

#1 oxidized 2.56 Ang hr

2 2.91 " "

" 3 " 4.22 " "

#1 1.92 Ang hr 3.44

#2 3.40 " "

#3 4.05 " "

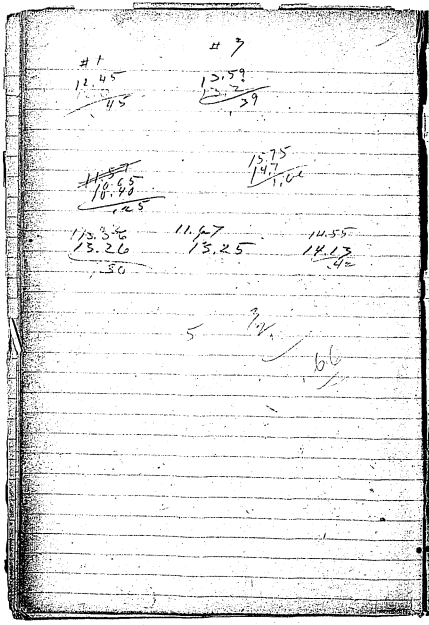
1 3.23 3.24

2 3.50 3.59

3 3.95 Ang hr

Effect platelet 3.86

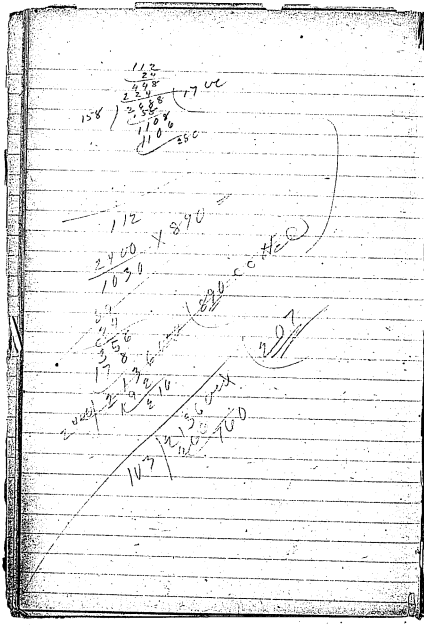
New grid 3.94



#1 #3
12.45 13.59
.45 .39
15.75
14.71
1.04
10.65
10.90
.25
13.34 11.67 14.55
13.26 13.25 14.13
.50 .42

48

#1 NaOH and #2 KOH and #3 Sol NaOH
Start plating at 5 P.M. 9-12-43
.11 Amps
gain at start
Nickle plating grids, bottoms
Current off 5 P.M. Na grids black
& gas like off on water line when
weight of bolsters #1-.45 #2-.39
Local action strongest on #2
Current on 8-25 .112 Amps
Quarter #1 #3 in HCl
Current off 10.25 .11 Amps
#1 #3 N.G. #2 slight black
fringe on water line O.K.
Gain on #1 .25
Current on 8-20 9-13-43 12-25
Local action strong on #3
9-45 Coleman closed #1 in the
Sharpsville #3 with H2 & vacuum
new grids
All off 12-10 .11 Amps
Gain on #2 1.05 gr.
on 1-30
New grid #3 3-40 Gain .42
" " #1 4-0 " .30
all off 5:3



Cement for prod —

1 mg hr — = .0374 gm H —
= .0374 × 8 = .2992 gm O —
= .299 × 4 = 1.196 gm Cu —
= 299 × 5 = 1.495 gm Cu O —

KOA well with Tornado Alt.
on 11 amp 1-35 9-13-99
@ 5:42 P.M. 2nd defrost cycle
for hard block lamps, not
better storm front from plain KOA
gain
on 8:30 AM - 9-14-99 2 amp
@ 12 same as front
Amp 12.90 1-35 197

90 cc NaOH 2 c/% Zn O mat
35 " " "
55 " H_2O "

In — 13.61 - 13.55 .27
On 2:35 9-13-99
Off 8-20 medium good INAF
Gain .27
On 8-30 AM 9-14-99 .18 Amp
off 12 Gain
mit 13.14 1-35 .197

90 cc KOH ZnO
90 cc NaOH ZnO
14.03 Zinc — 14.66 - .63
3 - P.M. 9-13 - 99
Off 8-15 .11 Amp - little better
Potassium zincate - Gain - .63
On 8-30 A.M. 9-14-29 .18 Amp
Off 12 very faint
Ht 13.45 1-55 1797

Continued from 48

#1 off 8-35 had

#2 " 8-35 more surf

than at first avoid Repeat

#3 off 8-40 2 Pds

#3 on 8-25 A.M. 9-14-99 Tide

#2 " 8-25 1200 ft

#1 "

#1 off 12 boat

" " "

#2 " " "

#1 & #3 thrown out

#2 at 13,17 on 1:35 1197

Pure NaOH

Amount of Na for 100 c.c. 2 gr.

NaOH sol. — Sp. Gr. = 1.225

Total wt. = 100 × 1.225 = 220.5 gr.

220.5 × 2.0 = 441 gr. NaOH.

NaOH = 23 + 16 + 1 = 40

Of Na = $\frac{23}{40}$ × 441 = 25.36 gr. Na

1225
1
0.0
1225.0

441
3
1323
882
1101.43
2536

Cells #1 & 1a -

~~Ga on plates #1 42.5 gr 19.0~~

Cell #1 - 6% Pot. KOH, purified by current, amalgam - Zn - Ni plates - Start at 10 AM - 9-21-99 - 4th cell - to begin to gen at 11 AM - continuous gen on plate - Zn covered with black deposit - H_2O_2 - clear - then off flavor - 2:30 white ppt appears & all turbid at bottom

Cell #1a - 180 cc 6% KOH, sp. gr. 1.247 purified by current - plates from #1 & to be placed in this - for local action

Cell #2 — 56

Mode of washing — Kept layer bare. Barely
covered on plate, charge + disc. on
404 rod — rod in 35% not by
2nd mist ordinary grade. —
Layer bare in bath awhile — .80 Amp hr
charge and Expose to same bath (plate varied
but in grid plate has been washed and
disc — 80 — disc — not shown much Ag —
seemed — take out grid and charge
time varied — 1.50 Amp hr —
Expose — 11:5 A.M. 9-21-98 .20 Amp hr
" charge 3-30 P.M. .33 Amp — 1.30 "
" disc 9 " .60 "
" charge 11:30 .12 " 1.32
" disc 9:45 A.M. 9-22-98 — .35 "
" charge 1:35 P.M. 1.02 Amp hr
" date 8-35 — 134

see 44 62

Cell #5 —

237 KOH by current
Ni plated grid with Electric Co
scale. Let amp Quick Z
Let 1 amp be sure, slow
& normal Z — After
grid is reduced give 1.4 amps
and let run at that —
12:15 P.M — 9-21-99 3 amps

1.96 / 8 = 1/4 = .245 gr Hi

8 Hi = 1 | 9.5
.037 | 2450 / 2250 / 200
5/13.46 / 2.69

2.69 / .0374 = 9021 / 5761 / 4760

4760 / 1960 / 1953 = 1.99

Lever suspension scale

Weight of grain = 1 4.45 - 4.50
" " Pocket 17.91 15.65
" " scale 13.46 gl. 11.15

Reduced 5.42 Avoir. lbs.
Reduced after 14 - 2.50 = 11.50
13.46 - 11.50 = 1.96 gr. 0 = 24.5 gr. H = 6.5 Troy
with partially exhausted and again reduced may have made the reduction more perfect.
Theoretical 0 2.69 gr —
" Avoir lbs 8.99

Weight Grain 11 oz. 5.97 - 5.95
" " Pocket 16.99 16.50
" " scale 10.97 10.52
Reduced 4.72 Avoir. lbs. [illegible]

Lake sup. scale

.7357 my. scale
die in H₂S from little sand
get .625 my. on the total
.5884 my.
boat a little on and a little
may be abridged. never
Tahoe Express on what
there is, not much good.

Baking grade

1 Silver bake wet — $Cu(NO_3)_2$
" " " dry "
" " " Cu acetate —
" " " wet Grape sugar —

9-27-99 6

To the ox in .25 Amp —

#4 — grid melt Saponin soak — soaked in an acetate sol. + baked — Cu_2 — 2 amp hr — 1.2 - 1.3 - 4.5 - 4.9 - 4.5

#5 grid - Sap. soak - soak in $CuNO_3$ — and bake (about 1½ Amp. hr. about of #4 in reduction) ox — 2.750 Amp hr — 2.4 - 3.4 - 3.7 4.0 - 3.8 - 4.2 - 3.8 - 3.6

#6 grid melt in pierce by Zn from $CuSO_4$ Cu_2 — 2 amp hr — 1½ hr — 1.0 - 1.7 - 2.1 - 2.2 2.1 - 2.4 - 2.5 - 1.9

#7 Ox grid — 5.77 wt plate — 14.53 plate ox — has a large amt metallic Cu — was prepared from pierce Cu + grape sugar — Theo. 10 amp hr — 4.0 amp hr — 3.5 - 4.5 - 4.2 - 4.0 - 4.1

#8 Ox grid 4.99 wt plate 13.25 Soln bake wet $CuNO_3$ — 3.5 amp hr — 3.0 - 1.7 - 3.2 - 2.1 - 2.8 - 2.5 3 - 2

~~10-3-99 9:45 9:35 AM~~
~~10-4-99 8:30 PM~~
~~10-6-99 10:20 AM~~
~~10-9-99 2:40 PM~~

~~10-2-99 9:15 PM~~ ~~10-4-99 9:50 AM~~
~~10-4-99 7:25 PM~~ ~~10-10-99 8:25 AM~~
~~10-6-99 4:50 PM~~ ~~10-11-99 3:50 PM~~

~~10-2-99 8:0 PM~~ ~~10-5-99 8:5 AM~~
~~10-6-99 5:25 PM~~ ~~10-11-99 4:30 PM~~
~~10-16-99 8:20 AM~~ ~~10-18-99 6 PM~~
~~10/19/99 3.0 gm~~
~~10-2-99 7:40 PM~~ ~~10-5-99 8:15 AM~~
~~10-6-99 8:00 PM~~ ~~10-11-99 7:20 AM~~
~~10-12-99 3:15~~ ~~10-19-99 8:45 AM~~ 10-19-99 1:30 PM
10/19/99 9.31 gm (clear)

~~10-2-99 9:10 PM~~ 10-4-99 8:30 AM
~~10-5-99 9:15 AM~~ ~~10-6-99 4:30 PM~~
~~10-8-99 2:40 AM~~ 10-11-99 9:50 AM

pp 66

#1 grid 4.92 plate 13.17
Silver plate scale dry much $CuNO_3$
3.6 conf hr – 3.1 – 3.6 – 3.5 – 3.3

pp 66

#10 grid 4.84 plate ~~14.34~~ ~~13.40~~ 12.75
Silver plate scale Cu acetate
3.5 conf hr – 3.0 – 1.9 – 2.5 – 3.2 – 2.7 – 2.4

#11 best off grid from scan scale –
m.35 4 conf hr
m.25 – 6.0 – 5.7 – 6.4 – 6.0 – 6.2 – 5.6 – 5.6

#12 best off plate, silver plate not – #11 12.75
but scan at 3.5 – 6 conf hr –
m.25 5.9 – 5.6 – 5.6 – 5.8 – 5.0 – 4.2 – 4.4
4.5 – 4.75 – 5.0 – 5.0 – 4.0 – 3.4 – 4.4 5.0-5

#16 Grid electron scale –
3.6 conf hr – 2.5 – 2.9 – 3.4 – 3.3 – 2.9 – 3.4

#13 ~~grid~~ wire Mp 65
grid 5gr - plate - 13.19
silver lake plate soaked in $CaNO_3$ + burned
3.8 aft dip - 2.4 - 1.9 - 1.2 - 2.9 - 3.1
Wires taken out have pit in grid -

Mp 67.
#15 10,152 gr sup - scale, reduced & refaced
04 - 4½ aft dip - 3.6 - 4.5 - 4.2 - 4.1 - 4.2

Mp 67
#14 grid 5.09 gr plate - 13.61
silver lake plate soaked in acetate burned
3.4 - 3.4 - 3.9 - 3.5 - 3.4 - 3.1 - 2.6

Mp 67
#15 grid wire 5.82 scale 9.87
sup scale, fine cu wire in grid -
2.4 aft dip - 2.4 - 3.0 - 3.30 - 3.4 - 3.3
3.5 -

Mp 65 -
#16 grid 5.46 gr scale 12.64
reburned scale, fine powder -
1.3 - 1.4 - 1.5 - 2.4 - 2.4

Mp 65
#17 grid gr plate 13.44 after dip 13.92
Silver lake plate dip 5 times in NH_4NO_3 + burn
3.4 - 2.4 - 2.5 - 2.0 - 2.0

10-30

10-3-99 8:20 AM - 10-4-99 8:45 AM

10-5-99 8:45 AM - 10-6-99 8:45 AM

10-7-99 8:35 AM - 10-8-99 8:45 AM

10-12-99 10:20 AM

10-4-99 8:55 PM - 10-10-99 10:20 AM

4:30

10-11-99 8:15 AM

10-7-99 1:45 PM

10-11-99 8:45 AM - 10-12-99 8:20 AM

10-13-99 8:15 AM - 10-14-99 8:30 AM - 5 PM

10-5-99 8:45 PM - 10-6-99 8:15 AM. 10-11-99: 10-20 PM

10-10-99 8:35 - 10-11-99 8:15 AM

10-12-99 8:45 - 10-13-99 8:30 AM

10-14-99 9:10 AM - 10-19-99 8:45 AM

10-19-99 9:45 AM.

10-20-99 8:20 AM - 10-21-99 8:50 AM

10-22-99 8:20 AM

64

M.67

gt- lake sup. rock worked mineral fines and separate of inborn epiclastic -
2.0 - 2.9 - 2.8 - 3.8 - 3.6 - 3.6 - 3.4 -

M. 66

Mt grad 6.17 fell with reduced typ. scale titak mt - 14.67 or 2.4 a/b

Mt grad 6.14 loaded -
Coarse mettif rock 0.5 - 1.1 - 0.7

Mt of plate 14.84 gr -
Silver lake ox. remnt with NA's solution - 5.2 - 5.2 - 4.0 - 2.8

M. 66 -

20 Abt 12 gr Cu definite and frequently osmate and burned out
1.8 - 1.8 - 1.8 0.2 -

Mt plate 11.68
Silver Lake ox to hydrate some small knop - 2.4 - 1.9 - 1.9 - 2.0 - 2.2 - 3.0

M. 67

Mt plate 2.6 -
Misc 15 gr Silver lake ox - 7/2 Cu NG
3.0 - 3.1 - 2.1 Inde

The annotated Rabe plates are
27 Feb

#3 Mt plate A 10.4yr
Initial scale and number 2.00 -
2.4 - 1.8 - 1.9 - 2.2 - 1.6 - 1.2 - 1.6 - 1.1 -

#5 Brent Cu annulus - faint lines in annulus 1.1 - 1.5 - 2.0 - 1.7 - 1.2
.9 - 1.1 - 1.3 - 1.8 - 1.7 -

#29 Mt plate 11.4 Silver lake ck
15yr growing - 2yr
3.5 - 3.9 - 4.5 - 4.4 -

#43 Mt plate 12.1 Silver lake ck
20yr 2yr increase -
3.8 - 4.5 - 4.1

#6 Mt plate 11.3 ordinary plate acquired & placed in grass lawn area
3.6 - 2.9 - 3.0 - 3.4 -

#46 Reduced plate scaled in Cm Sept plated in 3 zones
3.5 - 4.2 - 4.1 - 1.6 - 3.0 - 2.0 - 1 -

10-19-99 2 P.M.

10-19-99 8-40 AM

10-13-99 7-35 PM

10-13-99 8-45 AM

10-13-99 2:30 PM

10-11-99 11:00 AM

10-12-99 8:45 AM

8:30 AM 2:30 1:50

#5 Anal. by elect. bal. in H.
3.5 - 3.6 - 4.0 - 3.4

#6 Mt. 10.4 yr. ordinary grid reduce, anal. & heat in H - 2.0 - 2.4
2.1 - 2.8 - 3.0 -

#10 Silver Lake or with coal tar -
3.6 - 4.7 - 4.5 - 4.5 - 4.1

#12 Mt. plate 9.4 a precip by Z anal. Lasher anal. & heat in H -
1.7 - 1.8 - 1.7 - 1.6 - 1.7 - 1.4 - 1.9 -

#18 Common plate soaks in sugar sol. & bun fruice soak again + anal. -
4.5 - 3.4 - 3.4

#20 Common plate reduce soak in Hg

#20 Precip Cu anal. mould allow & Lasher & heat in H
.2 - .4 - .3 - .4 - .5 - .2 - .2 - .3 - .2 - .1

10-12-99 4:30 PM - 10-19-99 8:30 AM

10-13-99 10:40 AM - 10-19-99 11 AM - 10-19-99 6 PM

10-13-99 11:50 AM 10-19-99 2 PM

10-19-99 11:40 AM 10-19-99 8:40 AM. 23/10-99 7.30 a.m.
Hello Elcan

10-13-99 2:30 AM 4:15 PM. 2:30 AM 4:15 PM

10-19-99 11:40 AM. 10-19-99 2 PM

10-19-99 2:15 PM. [illegible] 7-30

10-13-99 12:20 AM - 7:30 PM - 10-19-99 7:30 AM

10-13-99 12 PM - 10-19-99 10 AM

10-13-99 11:45 A.M. - 10-19-99 2:15 PM -

10-19-99 11 AM - 10-19-99 7:30 AM.

10-13-99 12:30 PM - 7:30 PM - 10-19-99 8:30 AM

10-13-99 9:30 AM 11 AM 10-19-99 8:30 AM

10-14-99 8:30 AM 10-19-99 8:30 AM

10-14-99 10:30 AM 10-19-99 2 P.M.
7h. by R 12/10 2.45 p.m. not clear

10-12-99 8 AM. 10-19-99 11 AM. 10-19-99 1 P.M.

#12 2 freeze Cu amalg. harden, reamalg. harden burn in A -
2.7 - 2.8 - 2.5 - 2.8

#13 Brief reduced + amalg -
2.6 - 2.9 - 3.0 - 4.5 - 3.9 - 3.5 - 4.0

#9 Electr amalgam -
2 - 1 -

#14 Met Cu tinsel 6.24 in grid:
.2 - .4 - 1.2 - .4 - 1.0

#15 Transfer to NaOH rub. see ff 67
3.2 - 3.2 - 2.8 -

#11 Tinfoil soaked in Cu(NO3)2 + burned 20%
.4 - 1.1 - 1.1 - 1.1 - 1.1 - 1.1 - 1.2 -

#16 Reduced plate acted on by AgNO3
2.6 - 3.4 - 3.8 - 4.3 - 3.0 - 4.1
3.2 - 3.4

#2 Old #7 plate KOH with K2SO4
2.9 - 3.7

~~10-16-99 9:00AM~~ clear
10-18-99 8:30AM (6th sec by R) 9 1/10 10:30 a.m

~~10-17-99 9:00AM~~ 2 1/10 9:00 a.m 9 1/10 9:00 a.m
~~10-18-99 9:00AM~~ clear
10-19-99 11AM (7th by R) 9 1/10 10:00 a.m.

~~10-16-99 9:00AM 10-17-99 9:00AM~~ very clear
10-19-99 7:30PM 1 min 1 hour by R.
9 1/10 7:30 a.m

~~10-16-99 9:00AM 10-17-99 9:00AM~~
~~10-18-99 8:00AM~~ 10-19-99 1PM
very very clear
~~10-16-99 9:00AM~~ (double line)
~~10-17-99 9:00AM~~ (Run 15th 3d by R)

~~10-16-99 4:00PM~~ [2 1/10 8:30 a.m (clear)
~~10-17-99 8:30AM~~
10-19-99 7:30PM 1 hour by R.
10-17-99 8PM 9th sec by R Blue

2 1/10 99. 9 a.m very clear

27 Silver lake ex. thru 200 mesh
4.4 - 3.9 - 4.1 - 4.2 4.2 - 5.5 - 5.0
4.5

28 Silver lake ex. with charcoal -
3.0 - 1.5 - 2.0 - 3.5 - 2.5

29 Silver lake ex. with graphite -
3.4 - 3.0 - 2.75 - 3.5 - 3.5 - 3.3

30 Silver lake ex. Zn O
2.5 - 1.5 - 2.0 - 1.6

31 General mixture -
4.1 - 4.7 - 4.9 - 4.5 - 4.3

32 Lake wet soak & Tar -
3.5 - 3.2 - 4.0 - 3.4 -

AG Ordinary grid -
5.1 - 6.1 - 5.0 - 5.5 - 5.5 - 5.4

AX Part of plate 13.4 gr. Ag Nb3 Mgn Co 0.40
cement wet & soak -
3.5 - 3.2 - 2.9

23/10/99 9.30 am (clear)

[illegible] am (clear)

24/10/99 9 am rather clear

22/10/99 11.00 am mud on the platinum

25/10/99 9 am clear

24/10 9.30 am dark blue when charged [illegible]

26/10 9 am dark blue when charged

26/10 9 am light blue when charged

23/10 9.30 am light blue when charged

#5 Potentiometer much 14.5 gr.
5.0 - 4.5 - 5.1 - 4.1 - 4.8 4.8 - 4.0

#19 12.9 gr. Ox. from $CuNO_3$
3.25 - 3 - 2.75

#21 12.2 gr. 3/4 stick [illegible] 40 gr.
3.0 - 2.5 - 1.75

#23 17.6 gr. Litharge 15 gr. Ox 40 gr. soda
3.75 - 2.6 - 3.3 - 3.6 3.1

#X Ignorance
3.5 - 3.1 - 3.5 3.9

#XX Ppt 12.6 Bismuth nit. 6 gr. Ox 40 gr. soda.
3.1 - 1.9 - 1.7

#9 Ppt 13.6 Bi nit. 6 gr. Ox 40 gr. $CuNO_3$
4.5 - 2.25 - 2.8 - 2.2

#25 Wt 15 gr. Stannous ox. 6 gr. Ox 40 soda.
3.5 - 3 - 2.5

#24 Ppt 14 gr. Stannous ox 6 gr. Ox 40 $CuNO_3$
3.6 - 3.4 - 3.25 - 3.7 - 4.8 3.6 4.1 3.9

2½/10 77 7 am
rather clear

2½/10 77 9 am 2½/10.30 am

3½ 29 7 am
yellow & red ink charges

2½/10 99 9 am
very muclear

2½ 29 9.30 am 2½ 10.30 am
Rather cloudy

2½/10 99 9 am 11.30 am
Clear

2½/10 99 7.30 am dark mottled

2½/10 99 9 am 3 pm rather clear

2½/10 99 7.30 am rather clear

#8 11.8 gr 4 gr Bax 40 ox. $CuNO_3$ 24 hrs liquid
3.5 - 3.75 - 3.1 - 2.8 - 2.3

#20 MnO_2 0.6 gr 40 ox. cake 9.8 gr
3.25 - 1.9 - 1.8 - 1.9

#24 MnO_2 0.6 gr 0 ox 40 gr $CuNO_3$ 13.8 gr
3.75 5.25 - 4.1 - 3.1 - 3.3

#26 MnO_2 0.6 gr 0 ox 40 g $NiNO_3$
3.25 - 3.6 - 3.1 - 3.7

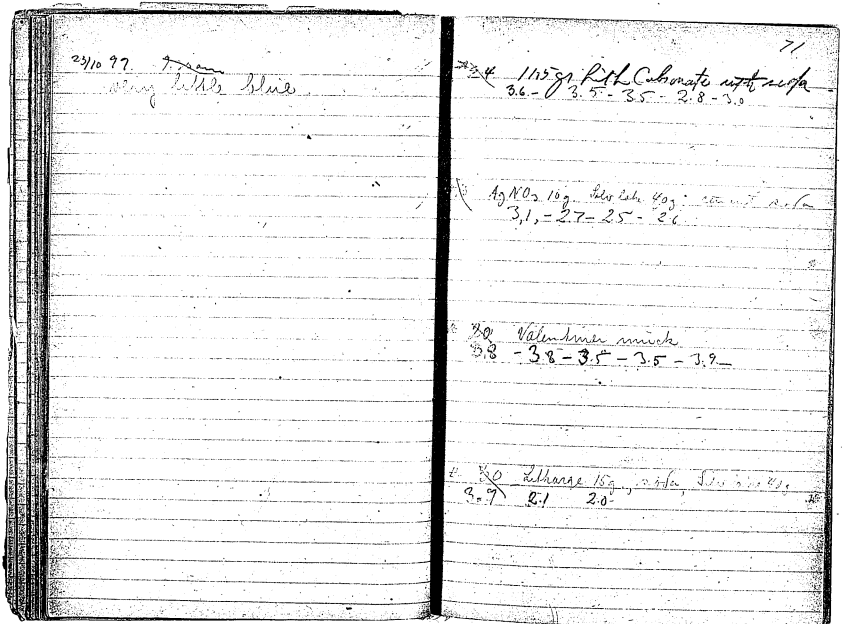
#17 Oxide from hydrate 13.2 gr
2.4 - 1.9 - 2.5

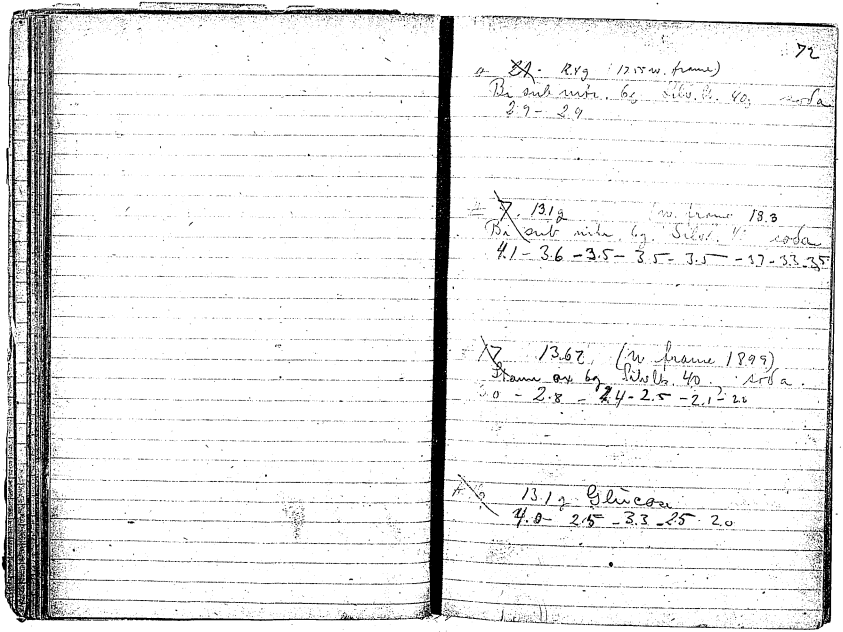
#15 Cement with $KClO_3$ 8.4
1.37 - 1.25 - 1.5 - 1.5

#22 Cement with $MnNO_3$
7.6 - 5.4 - 5.3 - 5.3 - 5.8 - 5.1 - 5.0

#30 15.2 Cement with Cement Cl. what ½ good
1.6 ± 1.5 1.5

#13 14.9 gr Cement with Lithia hyd
3.6 - 3.25 - 3.4 - 3.0 - 3.6 - 5.0


23/10 97
71
3.6 - 3.5 - 3.5 - 2.8 - 3.0
3,1 - 2.7 - 2.5 - 2.6
3.8 - 3.8 - 3.5 - 3.5 - 3.9
3.9 2.1 2.0



72

~~A~~ RVg (17.5 w. frame)
Br sub mite. 6g Silv. P. 40 soda
2.9 - 2.9

13.1g (w. frame 18.3
Br sub mite. 6g Silv. P. 40 soda
4.1 - 3.6 - 3.5 - 3.5 - 3.5 - 17 - 33.35

13.67 (w frame 1899)
Frame ox by Silv. P. 40 soda
2.0 - 2.8 - 2.4 - 2.5 - 2.1 - 2.0

13.1g Glucose
4.0 - 2.5 - 3.3 - 2.5 - 2.0

#28 (114g)
Borax 4g Silver CO_3 no Cl_2
2.4 - 1.9

#32 18.8g 15.5g
Borax 4g Silver CO_3 $CuNO_3$
2.9 -

#10 13.18g
MnO_2 6g Silver 4g no Cl_2
1.5 - 1.5 ~ 2.9

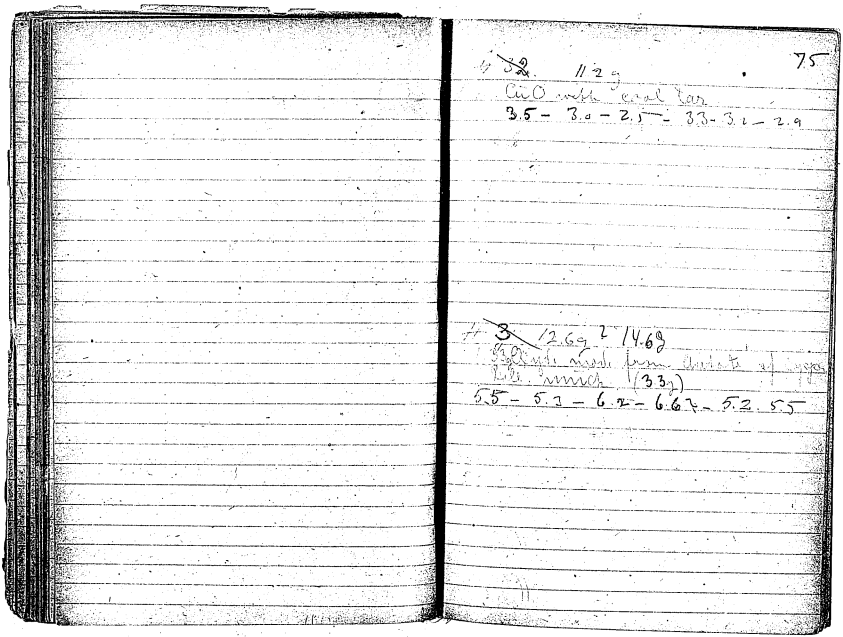
#35 8.7g
Cement with $FeCl_3$
1.3

11 13.6.2 g
Mn O 6 Sols 2½ Ca. Cu NO₃
2.1 – 2.3 – 2.8

12 14.7
Cement with Mn NO₃
3.3 – 4.1 x 2 4.0
with liquid
5.0

13 12.0
Cement with Sky Gel

14 11.4 g
With Carb. M. 2 Sols
2.2


4 ~~5.2~~ 11.2 g
CuO with coal tar
3.5 - 3.0 - 2.5 - 3.3 - 3.1 - 2.9

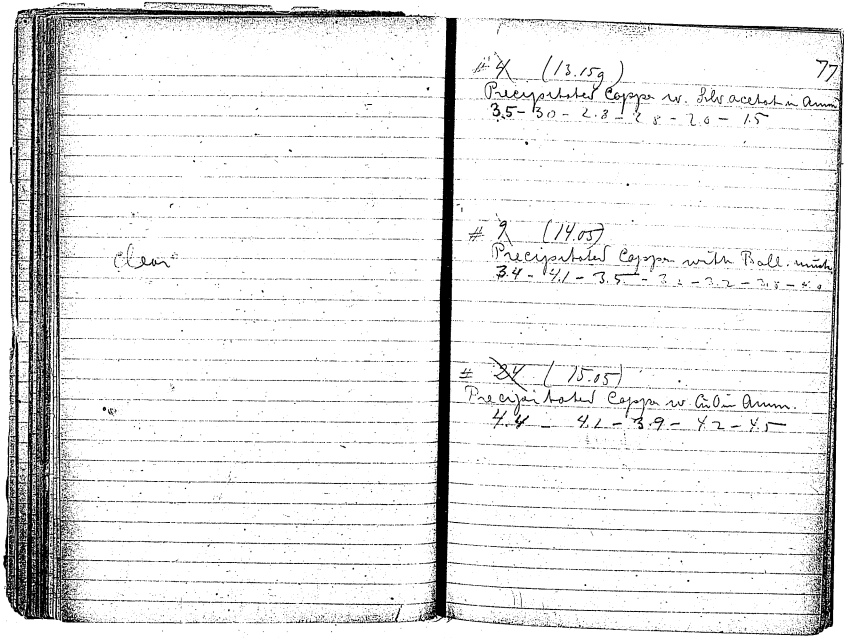
7.5

~~3~~ 12.6g & 14.6g
Copper made from Units of 1gm
Lots much (33g)
5.5 - 5.3 - 6.2 - 6.67 - 5.2 - 5.5

24 | 11 g.
12 | 4
20 – 28 – 27 – 2.

25 14 g
20
3.3 – 33 – 30 –

#18 12.95 g
Precipitated Copper w. Sugar solution
12 3.3 33 – 40 – 30 – 45



clear

77

7 (13.15g)
Precipitated Copper w. Silv. acetate in Ammo
3.5 - 3.0 - 2.8 - 2.8 - 2.6 - 1.5

9 (14.05)
Precipitated Copper with Ball. mixture
3.4 - 4.1 - 3.5 - 3.4 - 3.2 - 3.8 - 4.0

27 (15.05)
Precipitated Copper w. CuO in Ammo.
4.4 - 4.2 - 3.9 - 4.2 - 4.5

Mücek A.

Rosen	100	42.5 %
Wasser	125	53.25 %
Soda hydr.	10.	4.25 %

Soda soluer. 1:2 in Wasser

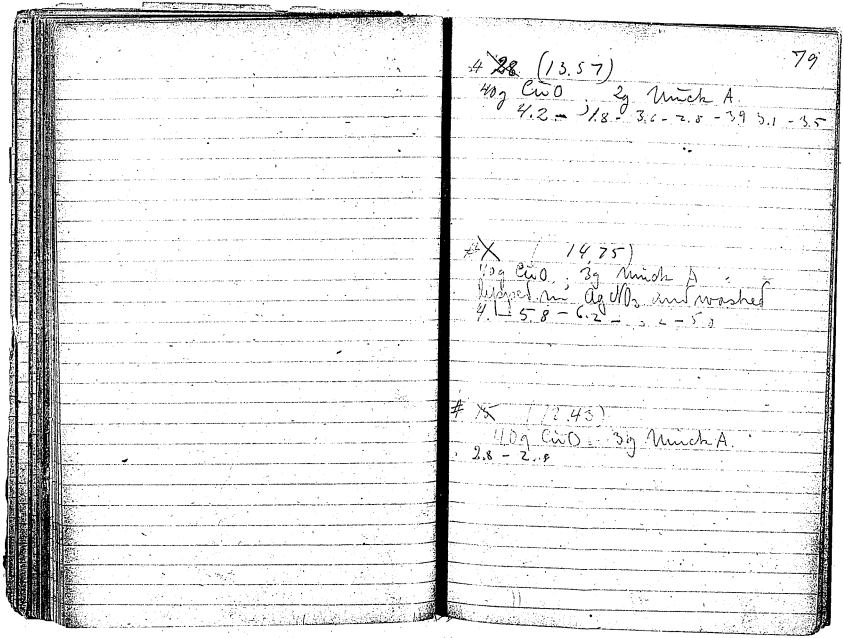
Mücek B

Rosen	100
Wasser	125
Soda hydr.	10
Resorcinum aa	30

~~#34~~ (13.05 g)
40 g CuO 3 g Mücek A
3.0 – 2.5 – 2.5 – 3.3 – 2.7 – 3.1 – 2.0

~~#~~ (13.40)
40 g CuO, 3 g Mücek B
3.6 – 3.1 – 3.5 – 1.8 – 3.2 – 4.1 – 4.1

#40 (13.17)
40 g CuO 4 g Mücek A
3.2 – 3.0 – 3.2 – 3.1 – 4.0 – 3.0 – 3.1



79

#4 ~~28~~ (13.57)
40g CuO 2g Mesh A
4.2 - 3.8 - 3.6 - 2.8 - 3.9 3.1 - 3.5

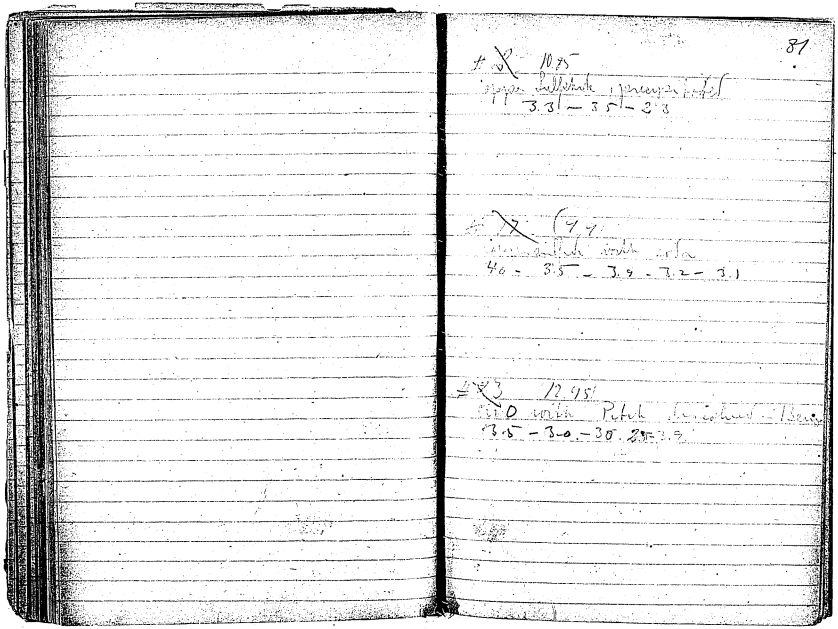
#X (14.75)
40g CuO 3g Mesh A
Impregnated w/ $AgNO_3$ and washed
4. - 5.8 - 6.2 - - - - 5.0

X (13.43)
40g CuO 3g Mesh A
2.8 - 2.9

31 (12.6.5)
400g CuO 3g Mischk A
3.8 - 3.0 - 2.8 - 3.9 - 2.8 - 3.1 - 2.9
3.1 - 3.3

32 14.3.8
400g CuO 3g Mischk A
Imprägniert mit KCN und wieder
4.3 - 4.1

34 (14.9)
CuO 400g 3g Mischk A
Imprägniert mit $Cu(NH_4Cl_2)_2$ und wieder
reprecipitiert mit KCN
4.3 - 3.9 - 3.7 - 4.1 - 4.5 -



Münch C.

Rosen 40 %
Weiss 50 %
Soda 10 %

dark blue

11.7.

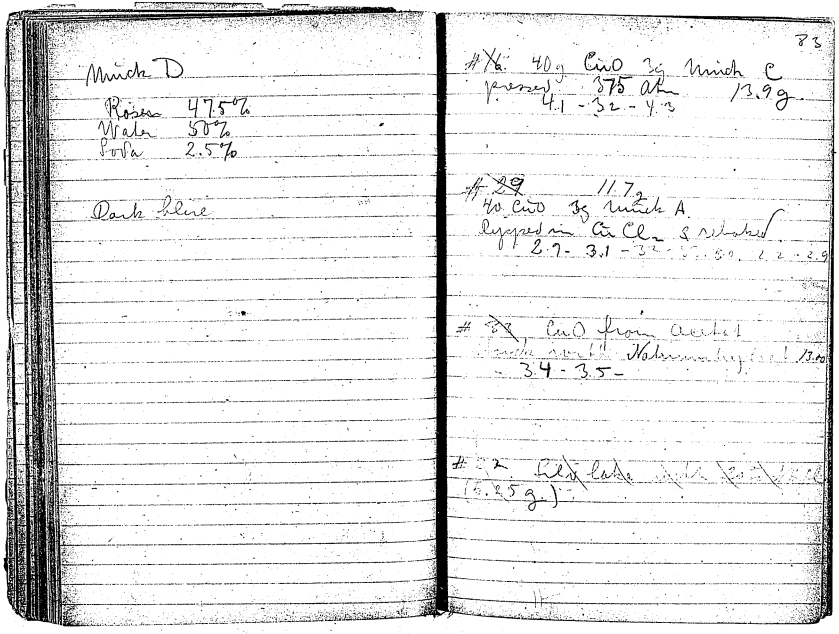
52

~~#~~ CuO 0.40 g Rolle Münch A 3 g
Silber Kugel Amalgamierung ca 15
Stunden 100 × 20/1000

3.7 - 3.9 - 3.0 - 3.8.

50. 40 g CuO 3 g Münch C.
Kugel Amalgamiert ab 50 Uhr.
(Strom 1 a 250 ohm) 14.23 g
3.9 - 4.1 - 4.1 - 4.2

CuO from $CuSO_4$ 13.5
3.8 - 3.2 - 3.5 - 3.2 - 3.4 - 3.5 - 3.6 - 3.4



Mixture D

Resin 47.5%
Water 50%
Soda 2.5%

Dark blue

83

#X: 40 g CuO 3g Mixture C
pressed 375 Atm 13.9 g.
4.1 - 3.2 - 4.3

#29 11.7
40 CuO 3g mixture A
Pressed in Cu Cl2 & reduced
2.7 - 3.1 - 3.2 - 3.0 - 2.2 - 2.9

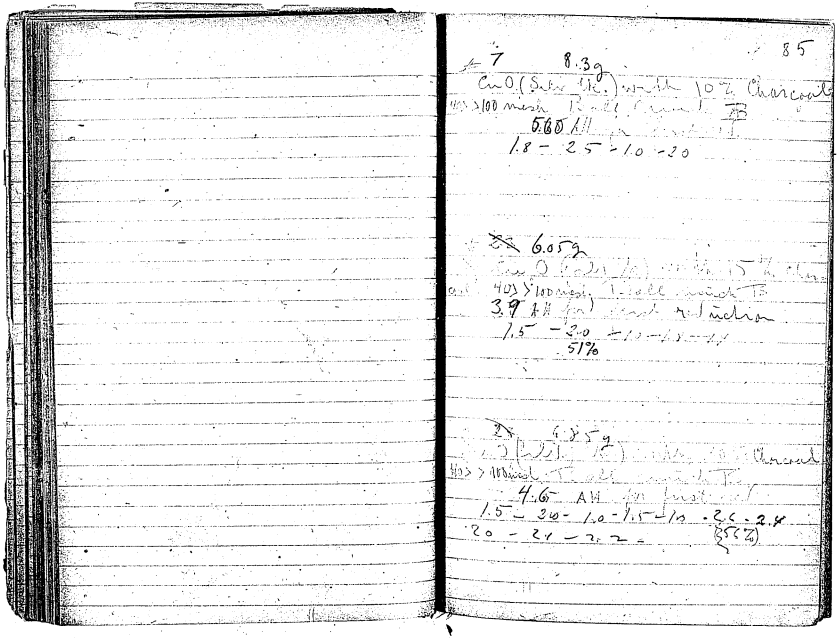
#[illegible] CuO from acetate
[illegible] Nahrungsmittel 13.0
3.4 - 3.5 -

#[illegible] Silk lace
(0.25 g.)

1/2 22 Pesh conds cl veg
Angel ms frome
5.3 - 62 - 40

1/4 10.80 f
5.3 cwt
pebble ; turn b d
first reducing: 6.2 angls (25.7)
pieces
28 - 31 - 34 - 30 - 13 - 23.21

1/4 10% comp Cu
[illegible] thick A ; 10.6
[illegible] reducing 5.7 angls (23.7)
Other [illegible]
18 - 16 - 14 - 20 -



85

#7 8.3g
CuO (Sch. Lt.) w/ 1% 10% Charcoal
40/> 100 mesh Tyler Screen B
5.60 AH
1.8 - 2.5 - 1.0 - 2.0

~~#8~~ 6.05g
CuO (Sch. Lt.) w/ 1% 5% Charcoal
40/> 100 mesh Tyler Screen B
3.9 AH for 1st reduction
1.5 - 2.0 - 1.0 - 1.5 - 1.1
51%

~~#9~~ 6.5g
CuO (Sch. Lt.) w/ 1% Charcoal
40/> 100 mesh Tyler Screen B
4.6 AH for 1st Red
1.5 - 3.0 - 1.0 - 1.5 - 1.0 - 2.6 - 2.4
2.0 - 2.1 - 2.2 - (95.2%)

#4 XX 8.25 g
CuO (Lab Prep) with 10% Mn O2
Ball Milled 5 hrs
5.75 AH in first reduction
2.5 / 50% - 2.5 - 2.0 - 2.0 - 1.8 - 1.5

#XX 9.2 g
Precipitated Cu with 5% Charcoal
1 x 2 mm mesh Brick with Lab
First reduction: 5.8 (98%)
Oxidation: 2.6 / 46% - 2.5 - 2.4 - 2.5

10.75 g
Precipitated Cu with 5% Charcoal
1 x 2 mm mesh Ball Milled 3 hrs
First reduction
Oxidation 3.1 - 3.0 - 2.4 - 2.8
2.5 - 2.6 - 2.6

20 9.0g
Precipitated Cu with 10% Charcoal (49>10)
Bench with Borax
First reduction 5—
Oxydation 2.6 – 2.5 – 2.0 – 1.5 – 1.4 – 2.1 (50%)

21 9.9g
Precip Cu with 10% Charcoal (40>10)
Boil much B.
First reduction
Oxydation 3.0 – 2.6 – 2.0 – 2.0 – 2.2 – 2.6 (47%)

23 6.5.5g
Pre. Cu with 20% Charcoal (41>>10)
Much TB
First reduction 4.2 (45%)
Oxydation 2.0 – 2.0 – 1.5 – 1.5 – 1.2 – 1.7 – 1.4 (45%)

Clear - light blue.
Spongy stuff from Kathode, covers the bottom

Clear - yellow -
a little stuff on Platinum, bottom almost per

#2 5.6 g.
Free Cu with 30% Charcoal
Bale much Ti
Just reduction 3.4 (90 - 5)
Oxydation: - - B

#8 9.7 g
This and following plates burned (carborized) in powder of charcoal
5% Charcoal 95% CuO, with Cu
Tarpentin in Benzol (also burning residues in H) from contact
15 - 16 - 15 - 15 - 2.5 - 2.5 - 2.8 - 2.7 - 1.8

#7 10.1 g
as #10
49 - 46 - 25 - 5.5 - 3.8 - 1.5 - 2.5
(72) (175)

intensive blue on bottom
clear - yellow - intensive red.
Prec from Rath from bottom.

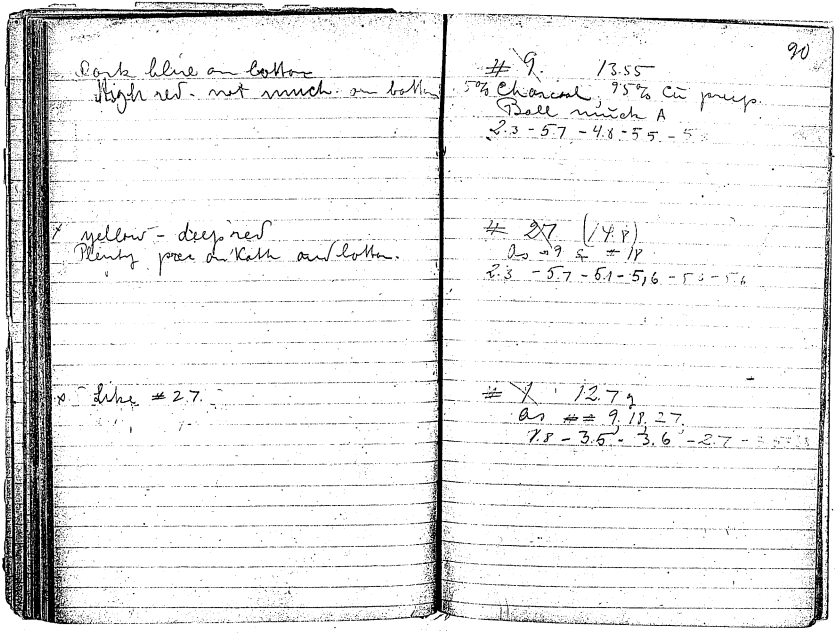
Blue on bottom (½")
grey - yellow - red
some prec from Rath on bottom.

Blue streak from bottom right red, bottom
rather prec

30 14.1g
5% Charcoal, 95% Prec. Cu. -
Jar) Wood Pitch, in Rempel
(vertices, after burning in H)
2.3 - 5.4 - 4.7 - 5.5 - 5.6

31 13.95g
As # 30
2.3 - 5.7 - 5.1 - 5.5 - 5.4 - 5.1 -

28 (14.6g)
5% Charcoal, 95% Cu prep
Ball mech R. (in H)
2.3 - 5.7 - 5.1 - 5.6 - 5.1 - 5.6 - 5.



Dark blue on bottom
High red - not much on bottom

yellow - deep red
Plenty pres. on both ends & bottom.

Like ≠ 27.

90

≠ 9. 13.55
5% charcoal, 95% Cu prep.
Ball mush A
2.3 - 5.7 - 4.8 - 5.5 - 5

≠ 27 (17.9)
Ag = 9.5 ≠ 19
2.3 - 5.7 - 5.1 - 5.6 - 5.3 - 5.6

≠ X 12.7
Ag ≠ 9.18 = 7.
7.8 - 3.5 - 3.6 - 2.7 - 3.5 - 3.1

Yellow - high red.
Pearly pale on both and bottom

Dark blue on bottom
Subtransparent brownish red.
Pale on both & bottom

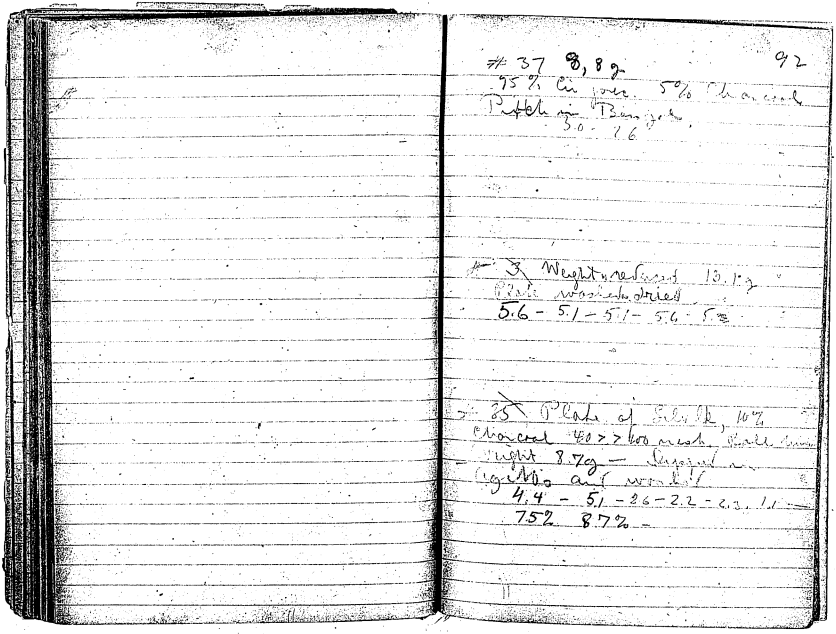
Blue from bottom upwards.

#24 10.85 g
5% Charcoal 95% Cinder
1.3 - 1.6 - 2.0 - 1.5 - 1.7 -

(9.9 g)
as #24
1.4 - 2.5 - 2.3 - 2.1 - 2.5 2.2

8 (9.65 g)
as #24, 32
1.3 - 3.5 - 2.3 - 2.0 - 1.7 - 2.8

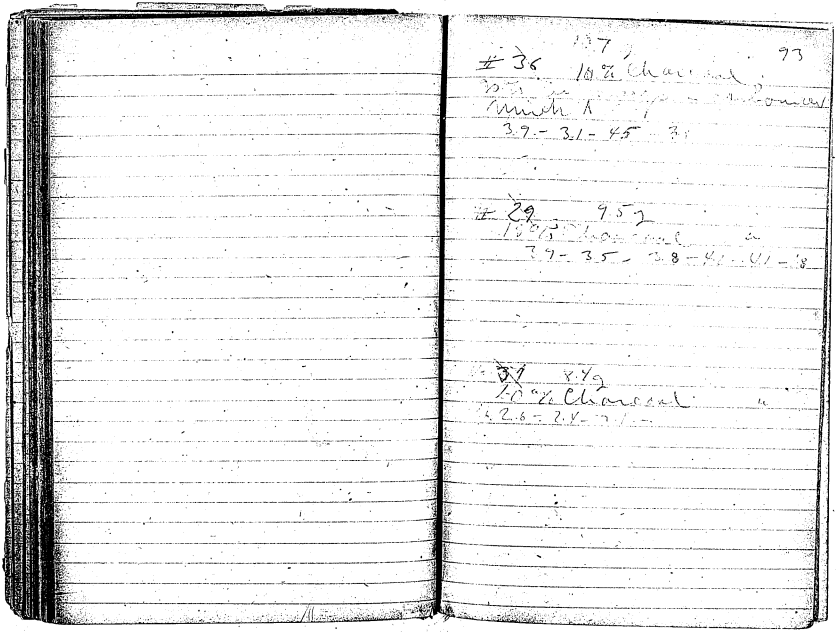
11 9.0 g
as #24, 32, 8
1.8 - 2.0 - 1.8 - 2.4

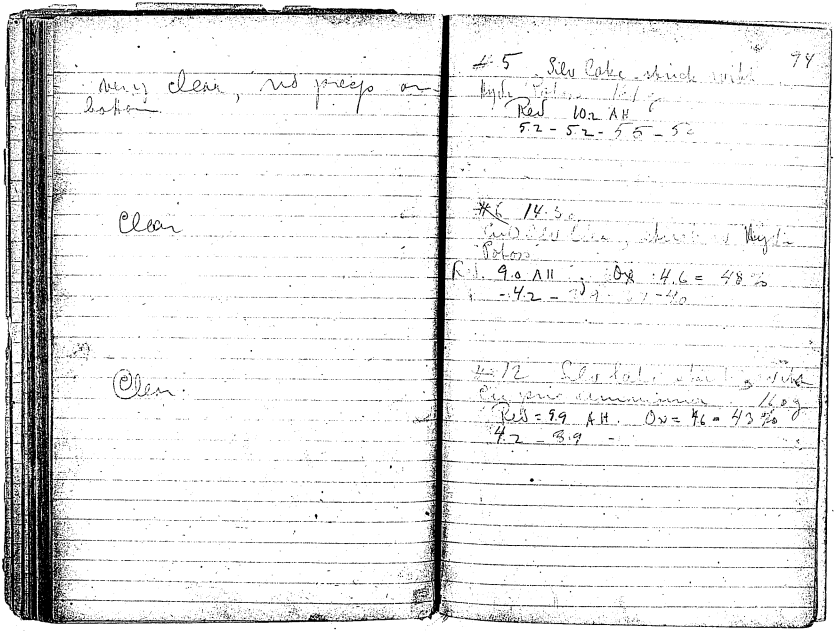


#37 8,8 g. 92
95% Cu powder 5% Charcoal
Packed in Bunsen
3.0 - 1.6

#3 Weight retained 10.1 g
Pink wash to start
5.6 - 5.1 - 5.1 - 5.6 - 5.8

35 Plate of Fe, Ni, 4%
charcoal 40 > 60 mesh. Pale pink
light 8.7g — Layered in
Ag Mo and weighed
4.4 - 5.1 - 3.6 - 2.2 - 2.3 - 1.1 -
7.52 8.7% -





very clear, no precip on horizon

Clear

Clear

74

#5 Silver Lake, thick white haze, light, [illegible]
Red 102 AH
52 - 52 - 55 - 52

#6 14:30
Sun still clear, thick white haze
Setors
Red 9.0 AH ; Ox : 4.6 = 48 %
42 - 39 - 40

#12 Salt Lake, Utah, thick haze, very clear
Red = 5.9 AH Ox = 4.6 = 43 %
42 - 3.9

Clear

95

38 14.0
Silv Lake stuff with
Imagine Ann reaction
1 Rest = 9.0 AH
OX = 4.2 HN = 44.5%
40 - SV - 30 - 30 -

14 10% Cinnamon 90%
Silv Lake Rest with
Regional = as NJ - worked
S:B 9 Rest 5.0 = 85%
OX = 2.5 = 42.5% - 30 - 21 - 21

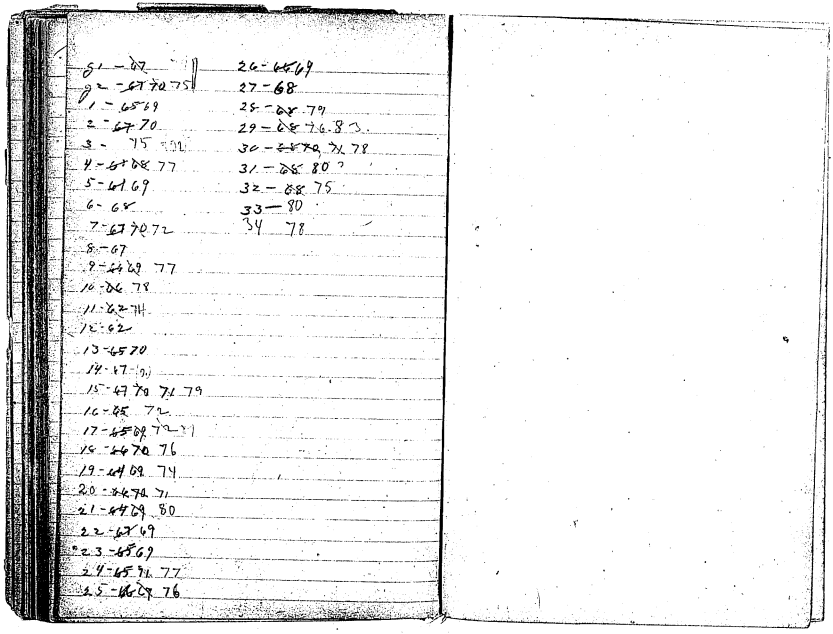
19 90% Cin Rice 10% Cinn
Good labor 40 - 100 work Cafe
Cinnamon 11,95 g

#55 9.2 g
10% Charcoal - Like the Ball mill
Digested in $AgNO_3$ and washed
2.6 - 1.0 - 2.6 - 1.2 -

#28 7.6 g
20% Charcoal, 60% (in Fe-a
burner (oxydized) shook w
Cupr Ammonia

14 12.2 g
Like the shook with
Ammonia, Digested in
$AgNO_3$ and washed
0% = 3.6 = 4.4 - 3.1 = 32

20 14.6 g
Like shook with KOH
Digested in $AgNO_3$ and washed
4.5 - 4.2 - 4.1 - 4.0 - 4.8
4.4 - 4.5 =



0 - 67
1 - 65 69
2 - 67 70
3 - 75
4 - 64 68 77
5 - 61 69
6 - 65
7 - 67 70 72
8 - 67
9 - 64 69 77
10 - 66 78
11 - 62 74
12 - 62
13 - 65 70
14 - 67 [illegible]
15 - 69 70 71 79
16 - 65 72
17 - 65 69 72 [illegible]
18 - 66 70 76
19 - 64 69 74
20 - 66 70 71
21 - 64 69 80
22 - 67 69
23 - 65 69
24 - 65 71 77
25 - 66 69 76

26 - 65 69
27 - 68
28 - 65 79
29 - 68 76 83
30 - 65 69 71 78
31 - 68 80
32 - 68 75
33 - 80
34 78